Report of the National Type Evaluation Program (NTEP) Committee

Ross Andersen
Director
New York Bureau of Weights and Measures

Reference
Key Number

500 INTRODUCTION

The National Type Evaluation Program (NTEP) Committee ("Committee") submits its Report for consideration by the 89th National Conference on Weights and Measures (NCWM). This consists of the Interim Report presented in NCWM Publication 16 as amended in the Addendum Sheets issued during the Annual Meeting that was held July 11-15, 2004, in Pittsburgh, Pennsylvania. The Committee considered communications received prior to and during the 89th Annual Meeting that are noted in this report

Table A identifies the agenda items in the Report by Reference Key Number, Item Title, and Page Number. The item numbers are those assigned in the Committee's Interim Meeting Agenda. A voting item is indicated with a **"V"** after the item number or, if the item was part of the consent calendar, by the suffix "**VC**". An item marked with an **"I"** after the reference key number is an information item. An item marked with a **"W"** was withdrawn by the Committee and generally will be referred to the regional weights and measures associations because it either needs additional development, analysis, and input or does not have sufficient Committee support to bring it before the NCWM. Table B lists the appendices to the report, and Table C provides a summary of the results of the voting on the Committee's items and the report in entirety.

This Report contains many recommendations to revise or amend National Conference on Weights and Measures (NCWM) Publication 14, Administrative Procedures, Technical Policy, Checklists, and Test Procedures or other documents. Proposed revisions to the publication(s) are shown in **bold face print** by ~~**striking out**~~ information to be deleted, and **underlining** information to be added. Requirements that are proposed to be nonretroactive are printed in *italics***.**

Note: The policy of NIST is to use metric units of measurement in all of its publications; however, recommendations received by the NCWM technical committees have been printed in this publication as they were submitted and may, therefore, contain references to inch-pound units.

Table A
Index to Reference Key Items

Table B
Appendices

Table C
Voting Results

Reference Key Number	House of Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
500 (Report in Its Entirety) Voice Vote	All Yeas	No Nays	All Yeas	No Nays	Passed

Details of All Items
(In Order by Reference Key Number)

1. International Organization of Legal Metrology (OIML) Certificate Project

Background: This item is included on the Committee's agenda to provide an update on NTEP's work to issue OIML R 60**,** "Metrological Regulation for Load Cells" and R 76, "Non-Automatic Weighing Instruments" Certificates.

OIML Certificate System: No new OIML Certificates have been issued by NTEP. The Committee agreed to withdraw this item from future agendas, preferring to consider the issue in the future as part of the Test Data Exchange Arrangements.

2. Test Data Exchange Agreements

Background/Discussion: This item was included on the Committee's agenda in 1998 to provide an update on NTEP's work to establish bilateral and multilateral agreements. Under such agreements and arrangements, manufacturers would be able to submit their equipment to any of the participating countries for testing to OIML-recommended requirements. The resulting test data would be accepted by other participants, as a basis for issuing each country's own type approval certificate.

Mutual Acceptance Arrangement (MAA): The OIML MAA document was adopted at the recent International Committee on Legal Metrology (CIML) meeting in Kyoto, Japan, in November 2003. Dr. Charles Ehrlich from the NIST Weights and Measures Division provided the NTEP Committee an update on the latest developments with the MAA. Refer to Appendix C of the Board of Directors report for additional information.

Mutual Acceptance Arrangement (MAA) The discussion of the MAA took place under item 1. of the Board of Directors' open hearing.

The Board reported:

1. Stephen Patoray, NTEP Director, will be attending an MAA workshop on the Declaration of Mutual Confidence (DoMC) in Berlin, Germany on October 25-29, 2004 in conjunction with a meeting of the CIML.

2. The Board reported the NCWM response to a questionnaire from BIML regarding the acceptance of OIML Certificates and test reports (data) along with short and medium intentions to participate in the MAA.

   One of the responses included the intention for NTEP to consider accepting R 60 OIML test reports for load cells, in the short term, and the intention to accept R 76 for Non-automatic Weighing Instruments and R 117 Measuring Instruments for Liquids other than Water test reports in the medium term.

   See Dr. Charles Ehrlich's letter in BOD Report Appendix B, section II, report on the Mutual Acceptance Arrangement on OIML Type Evaluations for additional information on the DoMC, testing laboratories, and Issuing Authority responsibilities.

   The acceptance of an OIML test report to issue an NTEP CC does not affect NCWM Conformity Assessment Program and the NTEP CC holder's responsibility regarding production meets type.

The Board asked the membership to consider the following questions:

1. Is participating in the DoMC as a participating testing laboratory under the MAA a core value for U.S.

2. Can the U.S. NTEP laboratories commit to the investment of time and resources to meet the requirements of a DoMC testing laboratory and participate in international assessments?

Bilateral Agreements: No additional discussions have been held on this topic, pending the outcome of the MAA discussions.

NTEP-Canada Mutual Recognition Program: The NTEP Laboratories met with Measurement Canada during the April 2004 Laboratory meeting to review and finalize the updated checklist for Weighing Devices.

At the 2004 NCWM Annual Meeting, NCWM Chairman Dennis Ehrhart and President of Measurement Canada Alan Johnston signed a two-year extension of the Retail Motor Fuel Dispenser Mutual Recognition Arrangement.

Additional related items

Participation in International Standards: During the 2004 NCWM Interim Meeting, Ross Andersen presented a PowerPoint presentation describing the current activity of NTEP and NCWM in International Standards. He gave an update on the participation at the recent US National Working Group R76/R60 meeting sponsored by NIST. Mr. Andersen also asked several questions for the group to consider. These included: What are the obligations of NCWM regarding harmonization of standards? What makes harmonization so difficult? He then proceeded to provide a possible method to make harmonization happen. There were also a series of questions regarding the specific actions that may be needed to actually participate in the MAA. Mr. Andersen left the group to ponder the question: Is the ability to issue OIML Certificates under the MAA a "Core Value" to the U.S.?

Report on 2004 Canadian Forum on Trade Measurement: During the 2004 NCWM Interim Meeting, Vice President, Measurement Canada Program Development Directorate Gilles Vinet provided an overview of the approach that Canada has chosen to pursue to improve their level of service to all of their stakeholders in Canada.

Report on the Asia Pacific Legal Metrology Forum (APLMF) and CIML Meeting: During the 2004 NCWM Interim Meeting, the NTEP Committee was given an update on the activities of attendees to these meetings.

3. Adoption of Uniform Regulation for National Type Evaluation by States

Background/Discussion: The Scale Manufacturers Association (SMA) has hosted NTEP adoption and implementation meetings for state directors at each regional weights and measures association conference. These meetings enable jurisdictions to share information about adopting and implementing NTEP in their respective jurisdictions, encourage non-NTEP jurisdictions to adopt the regulation, and allow current NTEP jurisdictions to share ideas on how to make enforcement more effective and uniform among the States. The meetings also provide NTEP management with information related to areas in which the operation and implementation of the program can be improved. Several questions have been posed at these meetings about issues associated with NTEP interpretation or practice. Comments from 1997 to 2003 have been summarized, without attribution, and are available for review and download on the SMA web site at http://www.scalemanufacturers.org.

At the 2004 Annual Meeting Dave Quinn, SMA reported there have been no changes to the map depicting the URNTE and VRR. Forty-seven (47) of the fifty-three (53) US states and Territories have adopted the URNTE. A copy of the map depicting adoption of the URNTE and VRR is included in Appendix F.

4. NTEP Participating Laboratories and Evaluations Reports

NTEP Director Stephen Patoray updated the Committee on NTEP laboratory and administrative activities since October 1, 2003, to June 2004. A report of the Activities was distributed to the NTEP Committee as the 2004 NCWM Annual Meeting and is included in the Final Report of the NTEP Committee in Appendix A.

The laboratory meeting was held April 25 through 28, 2004, in Ottawa, Canada.

5. NTETC Sectors Reports

The Committee heard an update on the activities of the 2003 meetings of the National Type Evaluation Technical Committee (NTETC) Sectors at the 2004 NCWM Interim Meeting. The Committee reviewed the recommendations from the various sectors on updates to NCWM Publication 14. The NTEP Committee accepted all of the recommendations and instructed the NTEP staff to make the necessary changes to NCWM Publication 14 for 2004.

The Committee also heard that an Ad Hoc procedure had been developed and was now being used to evaluate Class I and II scales for a counting feature per the recent changes made to NIST Handbook 44.

Grain Moisture Meter and NIR Protein Analyzer Sectors: The next meeting of the Grain Moisture Meter and NIR Protein Analyzer Sectors is scheduled for August 26 and 27, 2004, in Kansas City, MO. For questions on the current status of Sector work or to propose items for a future meeting, please contact the Sector Technical Advisors:

Diane Lee
NIST WMD
100 Bureau Drive – Stop 2600
Gaithersburg, MD 20899-2600
Phone: 301-975-4405
Fax: 301-926-0647
e-mail: diane.lee@nist.gov

Jack Barber
J.B. Associates
10349 Old Indian Trail
Glenarm, IL 62536
Phone: 217-483-4232

e-mail: jbarber@motion.net

Measuring Sector: The next meeting of the Measuring Sector is scheduled for October 22-23, 2004, in Gulfport, MS, in conjunction with the Southern Weights and Measures Association's Annual Meeting. For questions on the current status of Sector work or to propose items for a future meeting, please contact the Sector Technical Advisor:

Richard Suiter
NIST WMD
100 Bureau Drive – Stop 2600
Gaithersburg, MD 20899-2600
Phone: 301-975-4406
Fax: 301-926-0647
e-mail: rsuiter@nist.gov

Weighing Sector: The next Weighing Sector meeting is scheduled for August 29-31, 2004, in Ottawa, Ontario, Canada. For questions on the current status of Sector work or to propose items for a future meeting, please contact the Sector Technical Advisor:

Steven Cook
NIST WMD
100 Bureau Drive – Stop 2600
Gaithersburg, MD 20899-2600
Phone: 301-975-4003
Fax: 301-926-0647
e-mail: stevenc@nist.gov

Electronic copies of the NTETC Sector summaries are included in the Final Report of the NTEP Committee in Appendixes B through D. Electronic or hard copies of the NTETC Sector summaries are available upon request from:

NCWM Inc.
Phone: 240-632-9454
Email: ncwm@mgmtsol.com

or

NIST WMD Technical Advisor, Steve Cook
(See contact info above)

6. NTEP Participation in US National Working Group on Harmonization of NIST HB 44, NCWM Publication 14 and OIML R76 and R60.

In August 2003, Ross Andersen, NTEP Committee Chair, Steve Patoray, NTEP Director, and other representatives from various NTEP laboratories and States accepted an invitation from NIST to attend a US National Working Group meeting on OIML TC9/SC1. Ross Andersen updated the NTEP Committee on the activities of the U.S. National Working Group and progress and recommendations made up to this point.

7. Mix and Match Elements

During the 2004 NCWM Interim Meeting, Ross Andersen provided the group with an update on this item. He indicated that some U.S. manufacturers had questioned him about the possibility of using the OIML system of apportionment of errors in the evaluation of separate main elements (OIML calls them modules). The U.S. system applies a 0.7 fraction of the tolerance to any weighing/measuring or indicating element. In contrast, the OIML system recognizes that there may be more than two elements, in the system that contribute error. The OIML allows the manufacturer to apply different fractions of error to each element (module), from 0.3 to 0.8, provided the sum of the squares is less than or equal to 1 for the combined system. OIML also has specific criteria for evaluating compatibility of elements. At present NTEP Certificates specify that the separate main elements must be interfaced with compatible equipment but provide no guidance on how to evaluate compatibility. It appears that this issue will become more important over time. He advised that the U.S. should be looking closely at the issues involved and the changes that might be required in NIST Handbook 44 to allow the OIML system to be used here.

8. NCWM Publication 14, Administrative Policy on Pre-NTEP Certificates of Conformance

Proposal: Amend NCWM Publication 14, Administrative Policy The following language was proposed and discussed by the NTEP Committee and interested parties to be included in NCWM Publication 14 Administrative Policy. Further discussion and final decisions on this item will take place at the NCWM Annual meeting in July 2004.

Background: Current Policy from Section J.4. of NCWM Publication 14 Administrative Policy:

> Certificates of Conformance (CCs) issued as a result of type evaluation testing performed prior to the establishment of NTEP, that is Certificates that were originally issued as "pre-NTEP" CCs, may cover ranges of parameters within those included on the original pre-NTEP type approval certificates. The parameters covered must be within those allowed by the technical policy for the individual device type; parameters include elements such as device capacity, platform size, nmax, product type, etc. Pre-NTEP CCs cannot be expanded to cover parameters beyond those listed on the pre-NTEP type approval certificates without additional testing.

Recently NTEP was asked to amend a pre-NTEP CC for a Weighing/Load Receiving element that is used in Vehicle weighing. The original pre-NTEP CC listed the length of this device as 70 ft. According to current NTEP technical policy for this type of device, it is possible to have lengths up to 150 % of the device evaluated covered by an NTEP CC.

In discussion with the CC holder, data was submitted that showed the test that was conducted on the device. The testing was thorough and very similar to the testing that NTEP currently conducts on these types of devices. However, since this was a pre-NTEP CC, the administrative policy does not allow for the parameters to be expanded. The only alternative currently for the CC holder is to have the same 70 ft device evaluated again by NTEP. In this case, the rigid administrative policy did not seem fair.

Based on this information, the following proposal was presented to the NTEP Committee for consideration.

Proposed Language change to NCWM Publication 14, Administrative Policy

J. Variations in Type Evaluation

J.4. Expansion of Pre-NTEP Certificates of Conformance

Certificates of Conformance (CCs) issued as a result of type evaluation testing performed prior to the establishment of NTEP, that is Certificates that were originally issued as "pre-NTEP" CCs, may cover ranges of parameters within those included on the original pre-NTEP type approval certificates. The parameters covered must be within those allowed by the technical policy for the individual device type; parameters include elements such as device capacity, platform size, n_{max}, product type, etc. Pre-NTEP CCs cannot be expanded to cover parameters beyond those listed on the pre-NTEP type approval certificates without additional testing.

Upon written application filed with NTEP by the applicant, NTEP may grant exceptions to the provisions of this section when the applicant on such application provides evidence acceptable to NTEP that such exceptions are appropriate and maintain the integrity of the NTEP Certificate of Conformance. The decision to grant exceptions shall be based on information including, but not limited to, actual test data, test methods used, and current NTEP policy on evaluation and results.

At the 2004 NCWM Annual meeting, there was a discussion on the equivalence and quality of test data used to expand pre-NTEP Certificates of Conformance (CC) under the current administrative policy.

The Committee expressed that the intent of this change is to ensure that equivalent data from a public sector test organization is required and must exist in order to expand the device parameters of a pre-NTEP CC beyond the parameters of the original pre-NTEP CC. For example, pre-NTEP CCs for vehicle scales were based on data, including section test data, from public sector test organizations. Test loads and test patterns under the current NTEP Evaluation criteria would *not* permit acceptance of section test data conducted prior to the establishment of NTEP and CLC requirements.

9. Consolidating NTEP Device Types

At the 2004 NCWM Interim Meeting, Stephen Patoray, NTEP Director updated the Committee on the current status of device types. A list of suggested device types, which were reviewed by the NTEP Laboratories and the Weighing Sector, was discussed. Based on this information, the NTEP database has been updated and improvements were also completed on the NTEP Certificate search page on the NCWM website.

10. NTEP Laboratory Round Robin

A Computing scale is currently being randomly circulated among the five NTEP Laboratories. All of the laboratories are using the same checklist and procedures to evaluate the device. Once all five laboratories have evaluated the device, the final results from all five of the laboratories will be anonymously compared. We currently believe there is consistency in testing among the five laboratories. This round robin evaluation will add data and substance to that belief. However, if any inconsistencies are discovered, necessary actions will be taken by NTEP to properly address any deficiencies.

11. NTEP Technical Advisor

During the 2004 NCWM Interim Meeting, NTEP Committee Chairman Ross Andersen announced that the NTEP Director, will serve as the primary Technical Advisor to the NTEP Committee for all administrative duties and support. Steve Cook (NIST) will continue as Technical Advisor to the NTEP Committee for technical matters.

R. Andersen, New York, Chairman
D. Ehrhart, Arizona, NCWM Chairman
W. Diggs, Virginia
D. Onwiler, Nebraska
S. Pahl, Texas

NTEP Technical Advisor: S. Patoray, NTEP Director
NIST Technical Advisor: S. Cook, NIST WMD

National Type Program Evaluation Committee

Appendix A

NTEP Participating Laboratories and Evaluations Report

NTEP Application Statistics			
	Previous Quarter	**Current Quarter**	**Total To Date**
	10/1/2002-6/16/2003	10/1/2003-6/16/2004	10/1/00-6/16/2004
Applications Processed (Reactivations)	(4) 183	(2) 175	(44) 945
Applications Completed	151	67	687
New Certificates Issued	152	165	875
Certificates Distributed to State Directors	160	158	854
Certificates Posted To Web Site	158	157	3387
Active NTEP Certificates			1539

	Average	**Median**
Time For NCWM To Assign An Evaluation	10 days	8 days
Time For NCWM To Review A Draft Certificate	6 days	6 days
Time For Complete Evaluation	158 days	113 days

Appendix B

GMM and NIR Grain Analyzer Sectors

August 20-21, 2003
Kansas City, Missouri

Agenda Items

1. United States Department of Agriculture (USDA), Grain Inspection Packers and Stockyards Administration (GIPSA)/National Institute of Standards and Technology (NIST) Interagency Agreement Renewal
2. Update on NTEP Type Evaluation and Ongoing Calibration Program (OCP) (Phase II) Testing
3. Type Evaluation and OCP Issues
   a. Proposed Change to Publication 14 – Phase II Bias Tolerances
   b. Proposed Change to Publication 14 – Moisture Range for Hard White Wheat
   c. Correction to Grains Table in NTEP Application for Type Evaluation
4. Report on OIML IR 59 "Moisture Meters for Cereal Grains and Oilseeds"
5. Proposed Addition to OIML IR 59 to Address Influence of External Disturbances
6. Report on the 2003 NCWM Annual Meeting – GMM Issues
7. Proposed Changes and Additions to Publication 14 for Meters with Test Weight per Bushel Capability
   a. Additions to the "Type Evaluation Test Procedures and Tolerances" Section
   b. Changes/Additions to the Checklist Section

★ 8. NTEP Committee Authorizes "Dual Certification"
★ 9. Proposed Changes to Publication 14 to Improve Consistency between GMM and NIR Checklists
★ 10. NTETC GMM/NIR Sector Support - Response to Sector's Letter to NCWM Chairman
★ 11. Time and Place for Next Meeting

★ **Note**: Because of common interest, items marked with a star (★) were considered in a joint session of the NIR Grain Analyzer and the Grain Moisture Meter Sectors

---

1. GIPSA/NIST Interagency Agreement Renewal

The current five-year Interagency Agreement between GIPSA and NIST that provides funding for the Grain Moisture Meter On-going Calibration Program (OCP) will expire at the end of the Federal Government's Fiscal Year 2004 (September 30, 2004). Renewal of the Agreement is subject to an annual review to determine if changes should be made. Under the terms of the present agreement NIST and GIPSA each contribute one-third the cost of the program subject to an annual maximum of $18,000 each. The balance of costs is borne by manufacturers and depends on the number of meter models in the NTEP "pool" according to a fee schedule. The fee schedule has remained fixed since October 1, 1999. NIST and GIPSA have reviewed costs associated with the program and a revised fee schedule has been proposed. Implementation of the proposed fee schedule, which would become effective at the start of FY2005 (October 1, 2004), is subject to approval by both agencies. Rich Pierce, GIPSA, briefed the Sector on the proposed fee schedule, a draft of which is shown below.

Proposed NTEP On-Going Calibration Program Fee Schedule For Fiscal Year 2005 to 2009							
				Funding Contribution from Participants			
(1) Total Meters (including official meter)	(2) Meters in NTEP Pool	(3) Cost per NTEP Pool Meter	(4) Total Program Cost	(5) NIST	(6) GIPSA	(7) Manufacturers (total funding from mfg's)	(8) Cost per Meter Type
2	1	19,875	19,875	6,625	6,625	6,625	3,315
3	2	19,875	39,750	13,250	13,250	13,250	4,415
4	3	19,875	59,625	19,875	19,875	19,875	4,970
5	4	19,875	79,500	26,500	26,500	26,500	5,300
6	5	19,875	99,375	26,500	26,500	46,375	7,730
7	6	19,875	119,250	26,500	26,500	66,250	9,465
8	7	19,875	139,125	26,500	26,500	86,125	10,765
9	8	19,875	159,000	26,500	26,500	106,000	11,775

Explanation of columns in the Fee Schedule table:

Column	Explanation (or formula for calculating)
(1) Total Meters	The number of meter types (including the Official GIPSA meter) that will share in the NTEP calibration costs.
(2) Meters in NTEP Pool	The number of meter types other than the Official meter that will share in the NTEP calibration costs.
(3) Cost per NTEP Pool Meter	The cost associated with each pool meter in the program.
(4) Total Program Cost	A per meter type cost of $19,875 times the number of NTEP "pool" meters.
(5) NIST Contribution	One-third the total program cost up to a maximum of $26,500.
(6) GIPSA Contribution	One-third the total program cost up to a maximum of $26,500.
(7) Manufacturers Contributions (total funding from manufacturers)	Total Program Cost minus NIST Contribution minus GIPSA Contribution.
(8) Cost per Meter Type	Manufacturers' Contributions divided by Total Meters (including the Official meter.

Thus, if the current number of five meter types in the program (including the Official meter) remains constant, the annual cost per meter type under the proposed fee schedule will be $5,300 compared to the present annual fee of $3,600.

2. Update on NTEP Type Evaluation and OCP (Phase II) Testing

Cathy Brenner, GIPSA, the NTEP Participating Laboratory for Grain Moisture Meters, reported that no new grain moisture meters have been submitted for Type Evaluation in 2003. For the 2003 harvest, the following models will be enrolled in the OCP:
[**Note**: Models listed on a single line are considered to be of the same "type".]

DICKEY-john Corporation	GAC2000, GAC2100, GAC2100a
Foss North America	Infratec 1241
Foss North America	Infratec 1227, Infratec 1229
Seedburo Equipment Company	1200A [Change in ownership - formerly listed as Motomco 919ES]
The Steinlite Corporation	SL95

Since the inception of the OCP almost 10 years ago, results for each grain and each meter have been compiled using SAS software and returned to manufacturers in voluminous paper reports. Rich Pierce, GIPSA, reported that GIPSA

has set a goal for next year to distribute these reports electronically, most likely as PDF files. This change is expected to require a number of minor changes in format, especially in those portions of the report where several graphs now appear on a single page.

3. Type Evaluation and OCP Issues

3.a. Proposed Change to Publication 14 – Phase II Bias Tolerances

Background: The NTEP Phase I program provides for calibration testing and approval of three or more grain types over a 6 % moisture range determined by the Sector to be the most economically significant for each grain. Basic 6 % moisture ranges are identified in the NTEP Application for Grain Moisture Meters. At the completion of Phase I testing, meters are typically biased close to the GIPSA, and NTEP laboratory, air oven reference. In the Phase II OCP, calibration performance is tested over a wider range of grain moisture content. Calibration performance is checked against both "Approved" (one-half of the Handbook 44 Acceptance and Maintenance Tolerance) and "Pending" tolerances ("Approved" tolerance plus a 95 % confidence interval). The "Pending" classification is used to identify the operating moisture range for each grain for field instruments.

Proper application of "Pending" tolerances can prevent requiring calibration changes based on insufficient data. Conversely, these wider tolerances allow field use of calibrations that are biased as much as 0.4 % to 0.6 % moisture content away from the reference air oven and other NTEP meters. Situations currently exist where calibrations do not meet NTEP Approval Tolerances for a single 2 % moisture interval, but do meet the wider tolerances of the "Pending" classification. These calibrations are still included on the NTEP Certificate of Conformance and are still being used in commercial transactions. In these instances, the calibrations no longer meet the criteria for NTEP Phase I calibration approval over the required basic 6 % moisture range.

Discussion: The Sector considered a proposed change to Publication 14 that would require calibrations to meet Phase I tolerances (without the application of a confidence interval) over the basic 6 % moisture range. A number of Sector members were concerned that different meter types were not as closely aligned as they could be. In the absence of a mandated change, some manufacturers haven't kept up with aligning their calibrations with the air oven.

Charles Hurburgh, Jr., Iowa State University, pointed out that if there is a statistically significant bias between two meters and both meet “Approved” tolerances, then the tolerance is too broad. It was suggested that statistics are needed to show that meters as a cluster are aligned with each other in addition to aligning with the air oven. Rich Pierce, GIPSA, reported that even though data from the most recent 3 years is considered in analyzing OCP results, the confidence intervals have not been greatly reduced. The problem is especially acute in the moisture regions outside the basic 6 % moisture range. With only the most recent 3 year data available, many of the 2% moisture intervals at the moisture extremes have an insufficient number of samples to support continued use at these moisture levels unless the manufacturer supplies supporting historical data. Any interval supported by manufacturer-supplied data (even if it is historical OCP data) is automatically classified as "Pending" approval under NTEP. In more than one instance this has caused previously "Approved" moisture ranges to be reclassified as "Pending" ranges. Steve Patoray, NTEP Director, questioned the intent of the first sentence of the definition of "Pending" which states, "A new calibration will automatically be placed in this category." Sector members agreed that, as presently worded, this sentence confused the definition. It was intended to apply to calibrations that had not been validated in the OCP. It was also suggested that once a calibration range has been classified as "Approved" it should not be reclassified as "Pending" in the absence of data. The need to distinguish between "Approved" and "Pending" approval ranges was questioned. While all agreed that in practical day-to-day use the distinction between "Approved" and "Pending" had no significance, several members believed the distinction was important to prospective GMM buyers who could use this information in making informed comparisons between different GMM models.

Conclusion: The Sector reached the following conclusions on the issues raised in connection with this agenda item:

1. The Sector agreed to recommend the following change to Publication 14 to require calibrations to meet Phase I tolerances over the basic 6 % moisture range (without the application of a confidence interval).

In the GMM Checklist of Publication 14, section "IV. Tolerances for Calibration Performance:" revise paragraph three, and modify the definitions of "Approved" and "Pending" to read:

In order for a calibration to remain on the certificate of conformance, the calibration must continue to meet "Approved" tolerances for all 2 % moisture intervals in the basic 6 % moisture range. This requirement is waived if a 2 % moisture interval contains fewer than five samples. For 2 % moisture intervals outside the basic moisture range, tolerances used to require a change in calibrations will include the application of a 95 % confidence interval to the maximum tolerance for each 2 % moisture interval. The intent of applying the confidence interval is to avoid forcing a calibration change based upon insufficient data. After only one year of data collection, the number of samples in some intervals will be small, and the confidence interval may be as large as the tolerance limit. In this instance, the calibration would have to be extremely poor before a calibration change would be mandated. After the instrument has been in the calibration program for several years, the confidence interval should be reduced to approximately 0.05 and recommendations can be made with greater certainty. The latest three years of data will be used to make decisions regarding the need to make a calibration update.

Approved: Corn, HRW wheat, and soybean calibrations will be approved based upon performance over the 6 % type evaluation moisture range and manufacturer supplied data. Continued approval requires acceptable performance as part of the ongoing national calibration effort.

Calibration data, collected as part of the national calibration program, must indicate that calibration performance meets the tolerances for each 2 % moisture interval before additional grains will be approved. Continued approval again requires acceptable performance as part of the national calibration effort, (i.e., none of the average differences between predicted and reference values for the respective 2 % moisture intervals exceed one-half the Handbook 44 acceptance tolerance within the basic 6 % moisture range and one-half the Handbook 44 acceptance tolerance plus a 95 % confidence interval outside the basic 6 % moisture range).

Pending: A new calibration that has not been validated by ongoing calibration data collected as part of the national calibration program will automatically be placed in this category. This category also includes calibrations that have not yet met the criteria for approval, but that also have not performed badly enough to be listed as not approved. Such calibrations may be used on NTEP-approved meters.

2. The Sector agreed to recommend revising the first sentence of the definition of "Pending" to clarify its intent.

3. Although first agreeing to recommend changes that, in the absence of data, would not cause a calibration range originally classified as "Approved" to be reclassified as "Pending," the Sector subsequently rescinded their recommendation. Among the reasons for taking this action was the fact that it would not be applicable to a calibration that had been changed after the original approval if NTEP lab data were no longer available for the range in question. The Sector was in general agreement that ranges supported by manufacturer supplied data (even if it is historical OCP data) should automatically be classified as "pending" approval, because the NTEP lab had no way to validate the integrity of such data. Additionally, because Part V of the GMM checklist, which lists a set of well-developed rules for dealing with inadequately represented moisture intervals and for handling manufacturer supplied data, would require extensive revision if extended moisture ranges were granted permanent approval in the absence of data indicating otherwise, the Sector decided to defer action on this proposal until the issues of approval tolerances and uniformity among meters could be studied more thoroughly.

A subcommittee was formed to look at approval tolerances and uniformity among meters. Dr. Charles Hurburgh, Jr., Iowa State University, agreed to act as chair. Other subcommittee members include:

Jack Barber	JB Associates
Cassie Eigenmann-Pierson	DICKEY-john, Corp.
Andrew Gell	Foss North America

G. Diane Lee	NIST-WMD
Tom O'Connor	National Grain & Feed Association
Richard Pierce	GIPSA [NTEP Participating Laboratory]

3.b. Proposed Change to Publication 14 – Moisture Range for Hard White Wheat

Discussion: The NTEP Application for Grain Moisture Meter evaluation and the Table of Moisture Ranges and Tolerance for Sample Temperature Sensitivity in Appendix D of the GMM Checklist in Publication 14 specify a moisture range of 10 % to 16 % for Hard White Wheat. The NTEP required moisture ranges were initially selected to represent typical market ranges. In the last 3 years, however, GIPSA has not received any 14 – 16% moisture samples of Hard White Wheat for the Phase II ongoing calibration program. It appears that a moisture range of 8 – 14% would be more appropriate for Hard White Wheat.

Conclusion and Recommendation: The Sector agreed to recommend changing the "NTEP Required Moisture Range" for Hard White Wheat from "10 % to 16 %" to "8-14%" in the table on page 4 of NTEP Application form for Grain Moisture Meters (Issue - January 2003). The Sector also recommended changing the Hard White Wheat moisture range from "10 % to 16 %" to "8 % to 14 %" in the table in Appendix D of the GMM Checklist of Publication 14 as shown below. [**Note**: Missing quotation marks also need to be added in the table's heading. In addition, Medium Grain Rough Rice with a moisture range of 10 % to 16 % and tolerance limit of 0.45 as approved at the Sector's September 1997 meeting needs to be added; this entry to the table was inadvertently omitted from the 2001 and 2002 editions of Publication 14.]

Moisture Ranges and Tolerance for Sample Temperature Sensitivity (for the "Other 12" NTEP Grains)		
Grain Type	**Moisture Range for Test**	**Tolerance Limit (Bias at Temperature Extremes)**
Durum Wheat	10-16 %	0.35
Soft White Wheat	10-16 %	0.35
Hard Red Spring Wheat	10-16 %	0.35
Soft Red Winter Wheat	10-16 %	0.35
Hard White Wheat	8-14 %	0.35
Sunflower seed (Oil)	6-12 %	0.45
Grain Sorghum	10-16 %	0.45
Two-rowed Barley	10-16 %	0.35
Six-rowed Barley	10-16 %	0.45
Oats	10-16 %	0.45
Long Grain Rough Rice	10-16 %	0.45
Medium Grain Rough Rice	10-16 %	0.45

3.c. Editorial Correction to Grains Table in NTEP Application for Type Evaluation

Discussion: Note 2 following the Table of Grain Types on page 4 of the NTEP Application for Type Evaluation states:

Similar grain types are grouped within double lines above; testing of a meter with any grain in a given grouping will enable the evaluation to cover all grains in the grouping. For example, successful testing of a meter with two-row barley will result in the issuance of a Certificate which lists all of the other types of grain within the grouping, that is six-row barley and oats.

The "double lines" referred to in Note 2 are missing in the current edition of the Application.

Conclusion and Recommendation: The Sector recommended restoring double lines to the Table of Grain Types on page 4 of the NTEP Application for Type Evaluation to separate the grain types into seven groups as shown below:

group 1:	Corn
group 2:	Soybeans
group 3:	Hard Red Winter Wheat
	Durum Wheat
	Soft White Wheat
	Hard Red Spring Wheat
	Soft Red Winter Wheat
	Hard White Wheat
group 4:	Two-Row Barley
	Six-Row Barley
	Oats
group 5:	Sunflower Seed
group 6:	Long Grain Rough Rice
	Medium Grain Rough Rice
group 7:	Grain Sorghum or Milo

[**Editor's Note:** Recent modification of Section 5.56(a) Grain Moisture Meter Code in NIST Handbook 44 to recognize indications and recorded representations of test weight per bushel will require modification of Note 2 to stipulate that the groupings apply only to testing for moisture and NOT to testing for test weight per bushel. The Sector has not taken action on this issue, but suggested changes to Note 2 are shown below with the expectation that the change can be considered an editorial change not requiring a formal Sector ballot.]

Similar grain types are grouped within double lines above; testing of a meter with any grain in a given grouping will enable the evaluation to cover the moisture calibrations for all grains in the grouping. For example, successful testing of a meter with two-row barley will result in the issuance of a Certificate which lists moisture calibrations for all of the other types of grain within the grouping, that is six-row barley and oats, provided supporting calibration data has been provided for six-row barley and oats.

4. Report on OIML IR 59 "Moisture Meters for Cereal Grains and Oilseeds"

Background: At an OIML TC17/SC1 meeting in Berlin, Germany on June 22, 2001, the U.S. Delegation put forth a series of proposals to revise OIML IR 59 "Moisture Meters for Cereal Grains and Oilseeds." These proposals were well received and it was requested that the U.S. prepare a draft based on the U.S. NTEP program. A rough draft of this document was reviewed at the August 2002 GMM Sector meeting. NIST, Weights and Measures Division (WMD) prepared a working draft, incorporating changes suggested by the Sector, and the draft was submitted to U.S. and International Working Groups in February 2003 for comment. NIST WMD, which is responsible for U.S. participation and representation in the technical activities of the OIML, compiled comments to the working draft for review by representatives of the U.S. National Working Group (USNWG). The working draft was modified to address comments where it was judged appropriate. The modified working draft and a table of responses to the comments received to the working draft were distributed to USNWG members May 28, 2003. Subsequently, the Secretariat (the Peoples Republic of China) distributed the revised working draft as the "First Committee Draft" to OIML TC17/SC1 for review and comment by the member states of the subcommittee. China has requested that any additional comments be submitted no later than August 31, 2003. To comply with this request, Diane Lee, WMD, asked USNWG members to submit their comments to her by August 18, 2003. The next OIML TC17/SC1 meeting is October 15-16, 2003 in Beijing, China.

Discussion: Diane Lee, WMD, reported that, as of August 19, she had not received any comments from the USNWG other than the recommendation covered by GMM Sector Agenda item 5. Sector members who are on the USNWG were urged to submit comments by an extended deadline of August 27 so they could be included in her submission to the Secretariat. One Sector member suggested removing the acidity index requirement of clause 5.4. The acidity index is a measure of fatty acids in oil seeds. The test is expensive and should not be necessary if care is taken to avoid using rancid/spoiled samples. Richard Cantrill, American Oil Chemists' Society (AOCS), noted that ISO TC-34/SC2, Oleaginous Seeds and Fruits, is working on a revision of ISO Standard 7700-2 *Checking the performance of moisture meters in use -- Part 2: Moisture meters for oilseed*, and that ISO 7700-2 makes reference to the previous version of OIML IR-59. He suggested that the Secretariat of OIML TC71/SC1 contact the

Secretariat of ISO TC-34/SC2 to make them aware that IR-59 was being revised. Diane Lee agreed to pass this suggestion on to the Secretariat of OIML TC71/SC1.

5. Proposed Addition to OIML IR 59 to Address Influence of External Disturbances

Discussion: OIML R59 (1984) includes the following requirement without specifying the details of the tests to be performed:

Influence of external disturbances – Additional tests are carried out on moisture meters containing electrical and electronic parts, to evaluate the disturbances caused by the external magnetic fields, electro-magnetic radiations, electrostatic discharges failures of the electric power supply (interruptions of short duration, transient over-voltages, etc.)

The First Committee Draft (May 2003) of OIML IR 59 includes no requirement covering the influence of external disturbances. At present, Grain Moisture Meters sold in the Europe must comply with the European Union's harmonized standard EN 61326 (incorporating amendments A1: 1998 and A2: 2001), *Electrical Equipment For Measurement, Control And Laboratory Use – EMC Requirements,* which specifies radio frequency emission limits as well as test requirements for immunity to external disturbances caused by external magnetic fields, electro-magnetic radiations, electrostatic discharges, surges, and failures of the electric power supply (interruptions of short duration, transient over-voltages, etc.). Including a reference to the influence tests of IEC 61326 (the equivalent of EN 61326) and specifying what constitutes a significant fault is suggested to correct this oversight.

Conclusion and Recommendation: The Sector agreed to submit recommendations for additions to sections of R59 as shown below to address the influence of external disturbances.

Add to the Metrological Requirements section:

5.9 Influence of external disturbances

5.9.1 When subjected individually to the disturbances specified in the immunity tests of IEC 61326 (latest revision) the meter shall not exhibit a significant fault as defined in 3.2.1.

Add to the Terminology section:

3.2.1 Significant fault
A fault the magnitude of which is greater than the magnitude of the maximum permissible errors in 5.3.1.

NOTE: The following faults are considered not to be significant.
a) Faults implying the impossibility to perform any measurement;
b) Transitory faults being momentary variations in the indication, which cannot be interpreted, recorded or transmitted as a measurement result; and
c) Faults giving rise to variations in the measurement results that are so large as to be noticed by all users of the instruments.

6. Report on the 2003 NCWM Annual Meeting

Background: Two items of interest to the GMM Sector were addressed as voting items by the Committee on Specifications and Tolerances (S&T) at the NCWM Annual Meeting on July 13-18, 2003.

356(a)-1 Recognize Indications and Recorded Representations of Test Weight Per Bushel
Source: GMM Sector
Recommendation: Modify Section 5.56(a) Grain Moisture Meter Code in NIST Handbook 44 to recognize indications and recorded representations of test weight per bushel.

356(b)-1 T.3. For Test Weight Per Bushel Indications or Recorded Representations
Source: Central Weights and Measures Association (CWMA)
Recommendation: Modify paragraph T.3. of Section 5.56(b) Grain Moisture Meter Code Section in NIST Handbook 44 to clarify that it applies to separate accessory devices (such as a beam balance test weight apparatus) used to determine test weight per bushel of grain samples for the purpose of making density corrections in moisture determinations.

For additional background refer to Committee Reports for the 88th Annual Meeting, NCWM Publication 16, April 2003.

Discussion: At the 88th NCWM Annual Meeting held July 13 – 18, 2003 the NCWM voted to adopt changes to NIST Handbook 44 proposed under **Agenda Item 356(a)-1** and **Agenda Item 356(b)-1**. The NIST Weights and Measures Division recommended that the proposal, Item 356(a)-1, include SI (metric) units of measurement. The S&T committee heard one comment that different methods are used for test weight measurements. The S&T committee made no decision to include the metric units and the original proposal from the Sector was accepted. In the U.S. the bulk density of grain is expressed in pounds per bushel and is based on a specific USDA test method. In Europe (and other countries using the metric system) bulk density is expressed in kilograms per hectoliter and is based on a specific ISO test method. A straight units conversion of lb/bu test weight to kg/hL using the USDA method does not equal the kg/hL result of the ISO test method. A slope and bias must be applied to the units conversion to account for the differences caused by using two different test methods. When export contracts for wheat require that bulk density be certified in kg/hL, GIPSA currently uses a special adjustment from a U.S. test weight (lb/bu) to an "ISO standard" test weight (kg/hL). For all other grains, a simple units conversion is used to obtain values in kg/hL test weight. Some Sector members thought that the inclusion of a metric tolerance was potentially confusing in the U.S. marketplace. Others were of the opinion that this was not an issue in the U.S., because U.S. grain standards are based on the USDA test method for bulk density and are expressed in lb/bu. Several GMM manufacturers indicated that their devices had the capability of expressing bulk density in either U.S. Customary or metric units based on a straight units conversion. However, they stated that a different bulk density calibration was used for devices sold in countries where bulk density was based on the ISO test method. The Sector took no formal action on this matter.

7. Proposed Changes and Additions to Publication 14 for Meters with Test Weight per Bushel Capability

7.a. Additions to the "Type Evaluation Test Procedures and Tolerances" Section

Background: A subcommittee prepared a draft of additions to the "Type Evaluation Test Procedures and Tolerances" Section of NCWM Publication 14 to cover the evaluation of GMMs incorporating test weight per bushel (TW) capability. In developing the draft, which was presented to the Sector at its August 2000 meeting, the subcommittee considered the following:

1. To minimize the cost of type evaluation testing and provide an existing database for manufacturers to use in evaluating the proposed procedures, the subcommittee initially considered structuring tests to parallel the tests already established for GMMs. While this approach was determined to be feasible for most of the basic instrument tests, the subcommittee felt that test procedures and sample set selection should be modified for some tests to place the emphasis on test weight effects rather than on moisture effects. This was a particular concern for the accuracy, precision, and reproducibility tests in Phase I.

   A related concern is that Phase II samples are the primary source of Phase I accuracy samples. By the time air oven portions (200 g) have been cut out of the samples, only one-half to two-thirds of the samples are large enough to obtain a test weight reference value for Phase I tests using the procedures specified by the standard quart kettle method; the standard method requires a 1000 gram to 1050 gram sample for all grains except oats and sunflower seed. Also, the TW values currently being supplied to participants in the GMM Phase II on-going calibration Program (OCP) cannot be considered "official" test weight results. Some of these TW values are obtained using samples just large enough to fill the TW kettle with very little overflow. Sample packing and TW results are typically reduced for these samples.

Because TW readings are influenced by test conditions that affect grain surface characteristics, for some tests it is not desirable to use the same procedures for GMM and TW evaluations. For example, it seems desirable to reduce the number of repetitions per sample to avoid "polishing" grain samples. Also, it may be necessary to conduct all TW testing in an environmental chamber in which relative humidity can be controlled.

For the above reasons (and for the reasons given in item 3, below), TW evaluations were not incorporated into the existing Phase I GMM tests; instead, addition of a new subsection containing only TW test procedures and tolerances was proposed.

2. The subcommittee proposed that display and printout of TW be confined to moisture measurements within the 6% minimum NTEP required moisture range specified in the Application for NTEP testing for the following reasons: 1) measurement of TW beyond the upper limit of the 6 % range is going to be of questionable accuracy/precision; 2) the moisture region of greatest importance for TW is at or near normal moistures associated with storage or no-dockage-for-moisture levels which are included in the minimum NTEP required moisture range. The subcommittee's decision to limit TW to the "standard" 6 % moisture ranges was not unanimous. Tom Runyon, Seedburo, favored using the same moisture range for both TW measurements and moisture measurements, because grains coming into the initial receiving stations at harvest exhibit moistures that are at the upper levels of the approved moisture ranges. When there is an issue of low test weight due to poor weather conditions or stress during maturation stages, grain elevators need to identify a Low Test Weight condition at first receipt, not just after the grain has been dried to the lower moisture levels.

3. The matter of sample selection for TW was given serious consideration. Samples currently selected for moisture testing may not be suitable for TW testing. Because of existing criteria for selecting samples for Phase I moisture accuracy tests, it is already difficult to assemble a set of test samples. Imposing additional selection criteria for TW may make it impossible. The following criteria were included in the initial draft proposal submitted to the Sector:
   a) a total of 12 samples will be used per grain type.
   b) no less than 8 samples should come from the lowest two-thirds of the 6 % moisture range.
   c) no less than 2 samples should come from the highest one-third of the 6 % moisture range.
   d) samples should represent a distribution of TWs (ranges to be determined).
   e) for the entire population of 12 samples, the correlation (R2) between moisture and reference TW is to be less than 0.20.

4. The reference value for TW will be the average of 3 replicates on GIPSA's quart kettle apparatus. Samples will be dropped three times through each of two meters. The average of the initial and final reference values shall be used as the reference value in calculations of meter performance.

5. To have a sufficient number of measurements to determine TW accuracy, the subcommittee proposes that bias and Standard Deviation of the Differences (SDD) be calculated for each instrument using the entire sample set of 12 samples. In addition, a tolerance will be applied to the slope between measured TW (the average of the 3 TW measurements of a sample) and the reference TW (the average of 3 determinations as described above). Slope limits between 0.99 and 1.01 were proposed.

6. TW accuracy, repeatability, and reproducibility tests should be performed on all NTEP grains.

Discussion: In addition to reviewing the performance tests and tolerances in the Subcommittee's draft proposal, the Sector considered the following questions:

1. What TW range should be specified for Hard Red Winter wheat samples used in the instrument stability and instrument temperature sensitivity tests?
2. What TW range should be specified for samples used in accuracy, precision, and reproducibility tests?
3. Should the moisture range for TW measurements be restricted to a 6 % range? If not, how should the moisture range be determined, and should tolerances be different at higher moistures?

4. Should Phase II testing be required for TW? If so, how should tolerances be applied and over what range of moistures?

The questions related to limiting moisture ranges for TW measurements were the subject of lengthy discussion. The Sector acknowledged that for practical reasons samples used in NTEP testing would have to be of a restricted moisture range. Sample stability and availability were the major limitations to expanding the moisture range of samples used in Phase I testing. On the other hand, it seemed equally impractical to have different upper limits on grain moisture for TW than for moisture measurements, because grains coming into the initial receiving stations at harvest exhibit moistures that are at the upper levels of the approved moisture ranges. When there is an issue of low test weight due to poor weather conditions or stress during maturation stages, grain elevators need to identify a Low Test Weight condition at first receipt, not just after the grain has been dried to the lower moisture levels. In addition, restricting the display and print out of TW information at higher moistures would unnecessarily prevent measurement of TW for operational use (such as binning and drying) as opposed to commercial use.

The suggestion to allow display and print out of TW beyond the 6 % moisture interval provided the device gave a clear warning that the TW was "outside limits" was deemed impractical by device manufacturers who indicated that major firmware changes would be required to apply different moisture limits to moisture measurements and TW measurements for different grains. Other members expressed the opinion that different moisture limits would be confusing to producer and grain handlers alike.

One Sector member suggested that the issue should be viewed from the perspective of how TW affects the money paid for grain:

Corn - TW becomes important only if TW is very low. Low TW occurs only infrequently. In years when it does, it is typically common to an entire growing region. There is a big difference between typical TW and unusually low TW. Even if accuracy and precision of the TW measurement is reduced at higher moistures, it is still possible to identify a low TW condition.

Wheat - TW is important on wheat every day, but the proposed 10 % to 16 % moisture range is where most wheat is harvested.

Soybeans - TW is somewhat important, but the proposed 6 % moisture range includes normally harvested moistures.

This sector member concluded that allowing display of TW beyond the proposed limits was not a problem as there was no significant economic impact on TW accuracy beyond the proposed limits. Another member disagreed, citing the common harvesting of double-cropped soft red winter wheat in his area at moistures above 16 %. He questioned how field-testing should be handled if TW results are allowed to be displayed on higher moisture grains. Would the same tolerances apply to TW at higher moistures? If so, should a device be failed if it passes tests using samples within the 6 % interval but is out of tolerance on higher moisture samples? It was suggested that field-testing should be limited to moistures within the 6 % range. Refrigeration of TW transfer samples is not recommended, and the ability to maintain the integrity of test samples at higher moistures without refrigeration is questionable. Also, the precision of the device under test and the precision of the standard method begin to suffer at higher moistures. The Sector concluded that field-testing at higher moistures did not seem practical.

To satisfy both the need to limit moistures for NTEP Phase I testing and the need to provide TW indications at moistures beyond those used in Phase I tests, it was decided that grain moisture meters would be allowed to use the same moisture range for both TW measurements and moisture measurements. On CCs, TW calibrations would be shown as "approved" over a 6 % moisture range and "pending" over the remainder of the meter's moisture range. Participation in the Grain Moisture Meter Phase II calibration monitoring program would be required to verify performance over the TW "pending" range. Although the TW data available from the Phase II program may not be suitable for use in the basic instrument tests of Phase I, it was thought that the data would be acceptable for determining the degree to which TW measurements are a function of moisture over the device's operating moisture range. The Sector unanimously agreed to recommend that the following criteria be included in the checklist to address this concern:

- The slope of TW error with respect to TW shall not be significant at a 95 % confidence level over the 6 % moisture range.

- The slope of TW error with respect to percent moisture content shall not be significant at a 95 % confidence level over the "Approved" and "Pending" moisture range of the device.

For all the proposed Publication 14 tests, the Sector was in full agreement that the range of sample TWs should be no less than the range that is grade determining. For example, for yellow dent corn the minimum test weight per bushel is: 56 pounds per bushel for grade #1; 54 pounds per bushel for grade #2; and 52 pounds per bushel for grade #3. Thus, the minimum range specified for corn will be 52 to 56 pounds per bushel. The Sector did not specifically address the cases of rice for which TW is not a grade factor, and sunflower, which uses a single minimum TW (25 pounds per bushel) for all three grades.

The Sector reviewed a proposed addition to Publication 14 that reflected changes made to the subcommittee's draft by the Sector at its August 2000 meeting. The Sector also considered the following three items that had not been fully resolved at that meeting.

1) Sample Volume Test. The angle of repose of wet corn (22 %) is different than that of dry hard red winter wheat. If the device uses a sensor in the hopper to detect adequate sample size, it could conceivably pass the test on wheat but not detect insufficient volume when used with wet corn. Naturally moist wet corn may not be available at the time of year when a device is submitted for testing. It hasn't been determined that artificially moistened corn could be used for this test.

2) It was suggested that tolerances on some of the basic instrument tests were too tight. The subcommittee acknowledged that the tolerances were based on preliminary data and suggested that manufacturers be given the opportunity to see if they are appropriate. The Sector has received no comments from manufacturers to indicate that the tolerances are too restrictive. These limits remain in the draft as originally proposed.

3) What TW ranges should be specified for rice and sunflowers? TW is not a grade-determining factor for rice, and only a minimum TW of 25 lb/bu is specified for sunflower seed.

It was pointed out that the minimum TW ranges proposed for several of the grain types do not cover all the grades specified for those grains in the current U.S. Grain Standards. For example, the specified minimum TW for corn is 52 – 56 lb/bu. This covers only grades 1, 2, and 3. U.S. Grain Standards show requirements for 5 numbered grades with 46 lb/bu the minimum TW for corn. There was concern that expanding the ranges to cover the full range of TWs for all grades of a grain would make it difficult to obtain samples for testing. In many years very low TW samples are not available. The Sector agreed that the recommended ranges address the areas of economic significance.

Conclusions and Recommendation: The Sector decided to leave the Sample Volume Test as originally proposed. Corn will not be used for this test. The Sector has received no comments from manufacturers to indicate that the proposed tolerances are too restrictive, so the tolerances remain as originally proposed. Manufacturers are not required to have a TW calibration for rice, but the Sector agreed to a range of 42 lb/bu to 46 lb/bu for Long Grain Rough Rice and 44 lb/bu to 48 lb/bu for Medium Grain Rough Rice for testing purposes if a calibration is provided for those grains. A TW calibration for sunflower seed will be tested over a range of range of 24 lb/bu to 27 lb/bu. TW ranges were left as originally proposed. The Sector also decided that it would not be necessary to monitor TW calibrations in the OCP. Because TW depends on the direct measurement of mass and volume, TW calibrations are not expected to be subject to the same variations that affect moisture calibrations. It was reasoned that field inspection was adequate to verify TW. Consequently, the requirement for monitoring TW calibrations in the OCP was dropped from the proposed recommendation. TW data will still be collected routinely in the OCP and will be reported to manufacturers.

The Sector agreed to recommend adding the following new section (VII.) to the "Type Evaluation Test Procedures and Tolerances" section of the Grain Moisture Meter portion of NCWM Publication 14. [Editor's Note:

Changes/additions involving equations have NOT been highlighted or underlined. The MS change-tracking feature does not mark changes or additions made using MS Equation Editor.]

VII. Additional Type Evaluation Test Procedures and Tolerances for Grain Moisture Meters Incorporating an Automatic Test Weight per Bushel Measuring Feature

A. Basic Instrument Tests

Basic instrument tests will be conducted using a stable moisture (12 % to 14 %) HRW wheat sample to check the effect of sample volume variations, power supply fluctuations, storage temperature, leveling, and warm-up time. Instrument stability tests will be conducted using HRW wheat samples selected from all three 2 % moisture intervals in the 10 % to 16 % moisture range. All instrument tests will be conducted on each of the two instruments submitted by a manufacturer. For purposes of these tests, room temperature will be defined as 22 ºC ±2 ºC.

Sample Volume. A single HRW wheat sample with a moisture content between 12 % and 14 % will be used for this test. A quantity of 500 grams (or the maximum amount that can be loaded into the instrument's sample hopper) will be measured 3 times. This quantity will be reduced by 10 grams and then measured 3 times. The sample will continue to be reduced by 10 grams for each set of 3 measurements until the instrument no longer displays and records a test weight per bushel result. The average of each set of 3 measurements will be calculated.

The maximum difference between any of the calculated averages shall not exceed 0.30 pounds per bushel.

Initial Precision. A single HRW wheat sample with a moisture content between 12 % and 14 % will be analyzed 10 times at room temperature and nominal line voltage.

Precision will be checked.

The maximum allowable standard deviation of 10 analyses (precision) is 0.20 pounds per bushel.

Power Supply. (**Note**: This test may be waived for instruments that have met the grain moisture meter test requirements provided that the instruments use the same volume and weight determining means for both moisture and test weight per bushel measurements.) A single HRW wheat sample with a moisture content between 12 % and 14 % will be analyzed 10 times with the meter operating at a voltage of 100 V. The voltage will be adjusted to 117 V. After 30 minutes, the HRW sample will be analyzed 10 times. The voltage level will then be increased to 130 V. After 30 minutes, the sample will be analyzed 10 more times.

Changes in bias and precision will be checked. Bias is defined as the change in the average test weight per bushel for 10 analyses made at both the reference and the respective test voltages.

The maximum allowable bias change from the reference voltage (117 V) is ± 0.20 pounds per bushel. The maximum allowable standard deviation of 10 analyses (precision), at any of the three voltage levels, is 0.20 pounds per bushel.

Storage Temperature. A single HRW wheat sample (12 %-14 % moisture content) is analyzed 10 times at room temperature prior to temperature cycling. The instrument is then powered down and placed in the environmental chamber. The chamber temperature is then increased to 55 ºC over a 1-hour period, and maintained at that temperature for 3 hours. Chamber temperature is then decreased to -20 ºC over a 1-hour period, and maintained at that temperature for 3 hours. The temperature cycle is then repeated. After letting the instrument equilibrate to room temperature for at least 12 hours, the instrument is turned on for the specified warm-up period and the test sample analyzed 10 more times.

The maximum bias shift allowed for the average of 10 drops before and after temperature cycling is 0.20 pounds per bushel.

Leveling. (Note: This test will be waived for instruments that have met the grain moisture meter test requirements provided that the instruments are equipped with leveling indicators and use the same volume and weight determining means for both moisture and test weight per bushel measurements.) Tests for leveling will be conducted using a single HRW wheat sample (12 % to 14 % moisture content). The leveling test will be conducted for a minimum of 2 orientations, front-to-back and left-to-right, at a tilt of 5 %. Additional orientations will be tested as deemed appropriate.

The maximum allowable bias shift is 0.20 pounds per bushel for the average of 5 readings.

Warm-up Time. (**Note**: This test will be waived for instruments that have met the grain moisture meter test requirements provided that the instruments use the same volume and weight determining means for both moisture and test weight per bushel measurements.) The following test procedures will be used to check warm-up times recommended by the manufacturer. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after turning the instrument power on.

The instrument will be powered off and stabilized at room temperature. The instrument will be powered on and after waiting the specified warm-up time a single wheat sample (12 % to 14 % moisture content) will be analyzed 5 times. After waiting for a period of time equal to two times the manufacturer suggested warm-up time, the sample will again be analyzed 5 times. The minimum waiting period before retesting the sample is one hour. Thus, for an instrument where no warm-up time is specified, the sample would be tested immediately upon the instrument being powered up and then again after 1 hour.

The maximum allowable bias shift is 0.20 pounds per bushel for the average of 5 readings.

Instrument Stability. HRW wheat samples will be used to test instrument stability over a minimum 4 to 6 week period. A set of three samples, representative of the test weight per bushel range of 56 to 60 pounds per bushel, will be selected for testing. These samples may be a subset of the HRW test set for accuracy, repeatability, and reproducibility tests. Each of the 3 samples will be dropped 5 times through each of the two meters prior to running any other type evaluation tests, particularly before running the storage temperature test. The average test weight per bushel obtained for the 15 observations (3 samples x 5 replicates) will be recorded. The 3 samples will be retested once all other type evaluation testing has been completed (within 4 to 6 weeks).

The maximum allowable bias shift over the 4 to 6 week period is 0.20 pounds per bushel.

B. Accuracy, Precision, And Reproducibility Requirements Accuracy, Precision, And Reproducibility Requirements:

The automatic test weight per bushel measuring feature of grain moisture meters will be tested for accuracy, repeatability (precision), and reproducibility with 12 samples of each grain type for which the meter has a pending or higher moisture calibration. Samples will be chosen to represent the moistures and test weights per bushel shown in the following table. The reference method for test weight per bushel is the quart kettle test weight per bushel apparatus as specified by the USDA GIPSA. The reference value will be the average of 3 replicates. Samples will be dropped three times through each of two meters. The reference value will be re-checked after the meters have been tested. The average of the initial and final reference values shall be used as the reference value in calculations of meter performance.

Three replicates will be run on each instrument for each sample, resulting in a total of 72 observations of test weight per bushel per grain type (2 instruments x 12 samples x 3 replicates).

Type of Grain	Moisture Range	Minimum Test Weight per Bushel Range lb/bu	Criteria for Sample Selection
Corn	12 - 18 %	52 - 56	a) No less than 8 samples should come from the lowest two-thirds of the 6 % moisture range. b) No less than 2 samples should come from the highest one-third of the 6 % moisture range. c) Samples should represent a distribution of Test Weights per Bushel (TW) that minimizes the correlation between TW and moisture.
Soybeans	10 - 16 %	52 - 56	
Hard Red Winter Wheat	10 - 16 %	56 - 60	
Durum Wheat	10 - 16 %	56 - 60	
Soft White Wheat (except White Club)	10 - 16 %	56 - 60	
Hard Red Spring Wheat (and White Club)	10 - 16 %	55 - 58	
Soft Red Winter Wheat	10 - 16 %	56 - 60	
Hard White Wheat	8 - 14 %	56 - 60	
Two-Row Barley	10 - 16 %	43 - 47	
Six-Row Barley	10 - 16 %	43 - 47	
Oats	10 - 16 %	30 - 36	
Sunflower Seed (Oil Type)	6 - 12 %	24 - 27	
Long Grain Rough Rice	10 - 16 %	42 - 46	
Medium Grain Rough Rice	10 - 16 %	44 - 48	
Grain Sorghum or Milo	10 - 16 %	53 - 57	

Accuracy. The two tests for accuracy are bias (meter versus the standard reference method) and the Standard Deviation of the Differences (SDD) between the meter and the standard reference method. Each instrument will be tested individually.

$$Bias = \frac{\sum_{i=1}^{n} (\bar{x}_i - r_i)}{n}$$

where,

$\bar{x}_i$ = average predicted test weight per bushel for sample *i* (3 replicates)

r_i = reference test weight per bushel for sample *i*

n = number of samples (n=12)

$$SDD = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \bar{y})^2}{n-1}}$$

where,

y_i = $\bar{x}_i - r_i$ (see above)

$\bar{y}$ = average of the y_i

n = number of samples (n=12)

Tolerances for bias and SDD tests are one-half the absolute value of the NIST Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.4 pounds per bushel
All wheat classes	0.25 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.35 pounds per bushel

The manufacturer may adjust the calibration bias to compensate for differences from the type evaluation laboratory in reference methods or sample sets.

Repeatability. The Standard Deviation (SD) of the three test weight per bushel replicates will be calculated for each sample and pooled across samples. Each instrument will be tested individually. The equation used to calculate SD is:

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\sum_{j=1}^{3}(P_{ij} - \bar{P}_i)^2}{2n}}$$

where,

P_{ij} = predicted test weight per bushel for sample i and replicate j

$\bar{P}_i$ = average of the three predicted test weight per bushel values for sample i

n = number of samples (n=12)

Tolerances for repeatability are 0.4 x the absolute value of the Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.32 pounds per bushel
All wheat classes	0.20 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.28 pounds per bushel

Reproducibility. The results for each of the three test weight per bushel replicates will be averaged for each instrument, and the Standard Deviation of the Differences (SDD) between instruments will be calculated using the following equation:

$$SDD = \sqrt{\frac{\sum_{i=1}^{n}(d_i - \bar{d})^2}{n-1}}$$

where,

$d_i = \overline{P}_{1i} - \overline{P}_{2i}$

$\overline{P}_{1i}$ = average of three replicates for sample i on instrument 1

$\overline{P}_{2i}$ = average of three replicates for sample i on instrument 2

$\overline{d}$ = average of the d_i

n = number of samples (n=12)

Tolerances for reproducibility are 0.5 x the absolute value of the Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.40 pounds per bushel
All wheat classes	0.25 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.35 pounds per bushel

7.b. Proposed Changes/Additions to the Checklist Section

Conclusions and Recommendation: The Sector agreed to the following changes to the checklist section of the Grain Moisture Meter portion of NCWM Publication 14 to reflect recent additions/changes to NIST Handbook 44, Section 5.56(a) Grain Moisture Meter Code that recognize indications and recorded representations of test weight per bushel.

3. Indicating Elements, Recording Elements, and Recorded Representations

Code Reference: S.1.1. Digital Indications and Recording Elements

Note: Requirements cited for "test weight per bushel" indications or recorded representations are applicable only to devices incorporating an automatic test weight per bushel measuring feature.

3.1	The meter shall be equipped with a digital indicating element.	Yes ☐ No ☐ NA ☐
3.2.	The minimum height for digits used to display moisture is 10 mm.	Yes ☐ No ☐ NA ☐
3.3.	The meter is equipped with a communications interface and can transmit the date, grain types, grain moisture results, test weight per bushel results, and calibration version identification.	Yes ☐ No ☐ NA ☐
3.4.	A digital indicating element or recording element shall not display any moisture content values or test weight per bushel values before the end of the measurement cycle.	Yes ☐ No ☐ NA ☐
3.5.	The meter shall indicate and/or record in terms of percent moisture content wet basis. Test weight per bushel results shall be displayed and recorded as pounds per bushel. Subdivisions of these units shall be in terms of decimal subdivisions (not fractions).	Yes ☐ No ☐ NA ☐

3.6. Digital indicating and recording elements shall not display or record any values when the grain moisture content is beyond the operating range specified by the manufacturer, unless the moisture and test weight representations include a clear error indication. Yes ☐ No ☐ NA ☐

3.7. On multi-constituent meters (e.g., meters which also measure grain protein, starch and/or oil) provision shall be made for displaying and recording the constituent label (such as moist, prot., etc.) so as to make it clear which constituent is associated with each of the displayed and recorded values. Yes ☐ No ☐ NA ☐

Code Reference: S.1.3. Operating Range

3.9 A meter shall automatically and clearly indicate when the moisture content operating range has been exceeded. Meters shall not display a moisture result when operating temperature ranges are exceeded. In both instances, a clear error indication is required. A 5 °C tolerance is applied to temperature ranges when testing to verify that moisture results are not displayed or printed when the temperature range is exceeded. Yes ☐ No ☐ NA ☐

3.10. The operating range shall specify the following: Yes ☐ No ☐ NA ☐

3.10.1. The ambient temperature range over which the meter may be used is specified and moisture results are neither displayed nor printed outside this range. Yes ☐ No ☐ NA ☐

3.10.2. The temperature range for each grain or seed for which the meter is to be used is specified and moisture results are neither displayed nor printed outside this range. Yes ☐ No ☐ NA ☐

3.10.3. The moisture range for each grain or seed for which the meter is to be used is specified. Moisture and test weight per bushel values may be displayed when the moisture range is exceeded and an error message is displayed when values are outside the moisture and test weight range. Yes ☐ No ☐ NA ☐

3.10.4. The maximum allowable difference in temperature between the meter environment (ambient temperature) and the sample for which an accurate moisture determination can be made is specified. Moisture results are neither displayed nor printed outside this range. Yes ☐ No ☐ NA ☐

Code Reference: S.1.4. Value of Smallest Unit

3.11. The value of the minimum moisture increment indicated or recorded shall not exceed 0.1 %. Yes ☐ No ☐ NA ☐

3.12. Test weight per bushel values are determined to the nearest 0.1 pound per bushel Yes ☐ No ☐ NA ☐

3.13. A meter shall not record any usable values until the operating temperature necessary for accurate determination has been attained, **OR** Yes ☐ No ☐ NA ☐

3.14. The meter shall bear a conspicuous statement adjacent to the indication stating that the meter shall be turned on for a time period specified by the manufacturer prior to use. Yes ☐ No ☐ NA ☐

A meter shall meet all applicable tolerances when:

3.15. Operated in the temperature range of 10 °C to 30 °C (50 °F to 86 °F), or within the range specified by the meter manufacturer. Yes ☐ No ☐ NA ☐

3.16. If the manufacturer specifies a temperature range, the range shall be at least 20 °C (36 °F). Yes ☐ No ☐ NA ☐

Code Reference: S.2.6. Determination of Quantity and Temperature

4.7. The meter does not require the operator to judge the precise volume or weight and temperature to make accurate moisture determinations. Yes ☐ No ☐ NA ☐

4.8. For meters that measure test weight, the determination of sample volume and weight are fully automatic. Yes ☐ No ☐ NA ☐

4.9. Means are available to determine that a sufficient sample size is available and there is no display of test weight per bushel when there is insufficient sample to provide accurate measurements. Yes ☐ No ☐ NA ☐

4.10. External grinding, weighing and temperature measurements are not required for accurate moisture measurements. Yes ☐ No ☐ NA ☐

Code Reference: S.3. Accessory Equipment

4.11. If accessory equipment separate from and external to the moisture meter is required, it is appropriate and complete for the measurement. Yes ☐ No ☐ NA ☐

Code Reference: S.4. Operating Instructions and Use Limitations

4.12. Operating instructions shall be furnished by the manufacturer with each device. Complete information concerning the accuracy, sensitivity, and use of accessory equipment necessary in obtaining moisture content shall be included. Yes ☐ No ☐ NA ☐

In addition, operating instructions shall include the following information:

4.12.1. Name and address or trademark of the manufacturer. Yes ☐ No ☐ NA ☐

4.12.2. The type or design of the device with which it is intended to be used. Yes ☐ No ☐ NA ☐

4.12.3. Date of issue. Yes ☐ No ☐ NA ☐

4.12.4. The kind or classes of grain or seed for which the device is designed to measure moisture content and test weight per bushel. Yes ☐ No ☐ NA ☐

4.12.5. The limitations of use (e.g., moisture measurement range, grain or seed temperature, kind or class of grain or seed, instrument temperature, voltage and frequency ranges, electromagnetic interferences, and necessary accessory equipment). Yes ☐ No ☐ NA ☐

8. NTEP Committee Authorizes "Dual Certification"

Discussion: The NTEP Committee reviewed the following recommendation during the 2003 NCWM Interim Meeting in Jacksonville, FL and accepted the Sector recommendation to issue a single Certificate of Conformance to a device that has been evaluated using two inter-related codes.

501-7 Grain Moisture Meter (GMM) and Near Infrared (NIR) Instruments Dual Certification
Source: GMM and NIR Sectors
Recommendation: The Sectors recommended that NCWM, Inc. authorize issuing a single CC for devices successfully type evaluated using two inter-related codes (e.g., a "Grain Moisture Meter CC with Near Infrared Grain Analyzer Certification" or, simply, "NIR Grain Analyzer with Dual Certification").

Steve Patoray, NTEP Director, outlined changes being considered for improvements in the database that NCWM maintains for CC's. In the improved database, devices would be classified first by a generic name and then by a secondary name or descriptor. For example, devices used to measure an attribute of grain, whether moisture or protein, would be classified generically as "grain analyzers." Proposed subclassifications under "grain analyzers" are: moisture only, moisture plus test weight, and multi-feature. A grain moisture meter successfully evaluated under both GMM and NIR Analyzer codes would be classified as Grain Analyzer/Multi-Feature.

9. Proposed Changes to Publication 14 to Improve Consistency between GMM and NIR Checklists

Discussion: The NTEP Laboratory has pointed out discrepancies between the Near Infrared Grain Analyzer (NIR) and Grain Moisture Meter (GMM) checklists in Publication 14 for several similar tests. The following changes are suggested to improve consistency between the two checklists, to remove ambiguity, and to correct errors.

Conclusion: The Sector agreed to all of the following recommendations.

9.a. Power Supply Tests

Recommendation: Modify the Power Supply paragraphs of the "Type Evaluation Test Procedures and Tolerances" sections of the checklists for Near Infrared Grain Analyzers (NIR) and Grain Moisture Meters (GMM) respectively as shown below to improve consistency and to explicitly define the reference voltage:

NIR Checklist:
Power Supply. A single HRW wheat sample will be analyzed 10 times with the instrument operating at a voltage of 100 V. The voltage will be adjusted to 117 V. After 30 minutes, the HRW sample will be analyzed 10 times. The voltage level will then be increased to 130 V. After 30 minutes, the sample will be analyzed 10 more times.

Changes in bias and precision will be checked. Bias is defined as the change in the average protein for 10 analyses made at both the reference and the respective test voltages.

The maximum allowable bias change from the reference voltage (117 V) is ± 0.10. The maximum allowable standard deviation of 10 analyses (precision), at any of the three voltage levels, is 0.10.

GMM Checklist:
Power Supply. A single HRW wheat sample with a moisture content between 12 % and 14 % will be analyzed 10 times with the meter operating at a voltage of 100 V. The voltage will be adjusted to 117 V. After 30 minutes, the HRW sample will be analyzed 10 times. The voltage level will then be increased to 130 V. After 30 minutes, the sample will be analyzed 10 more times.

Changes in bias and precision will be checked. Bias is defined as the change in the average moisture for 10 analyses made at both the reference and the respective test voltages.

The maximum allowable bias change from the reference voltage (117 V) is ± 0.20 %. The maximum allowable standard deviation of 10 analyses (precision) at any of the three voltage levels is 0.10 %.

9.b. Leveling Tests

Recommendation: Remove the redundant first sentence of the Leveling Test of the NIR Checklist, and modify the wording of the tolerance sentence to specify that bias is calculated from the average of 5 readings. The proposed changes are shown below. [**Note**: the Leveling Test from the GMM Checklist is shown below for reference.]

NIR Checklist:
Leveling. The leveling test will be conducted for a minimum of 2 orientations, front-to-back and left-to-right, at a tilt of 5 %. Devices equipped with leveling indicators will be tested at the indicated limits of the level indicator rather than at a tilt of 5 %. Additional orientations will be tested as deemed appropriate.

The maximum allowable bias shift is ± 0.10 % for the average of 5 readings.

GMM Checklist:
Leveling. Tests for leveling will be conducted using a single HRW wheat sample with a moisture content between 12 % and 14 %. The leveling test will be conducted for a minimum of 2 orientations, front-to-back and left-to-right, at a tilt of 5 %. Meters equipped with leveling indicators will be tested at the indicated limits of the level indicator rather than at a tilt of 5 %. Additional orientations will be tested as deemed appropriate.

The maximum allowable bias shift is ± 0.20 % for the average of 5 readings.

9.c. Warm-up Time Tests

Recommendation: Modify the Warm-up Time tests of the NIR and GMM Checklists respectively as shown below to improve consistency:

NIR Checklist:
Warm-up Time. The following test procedures will be used to check warm-up times recommended by the manufacturer. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after turning the instrument power on.

The instrument will be powered off and stabilized at room temperature. The instrument will be powered on and after waiting the specified warm-up time a single wheat sample will be analyzed 5 times. After waiting for a period of time equal to two times the manufacturer's suggested warm-up time, the sample will be analyzed 5 more times. The minimum waiting period before retesting the sample is one hour. Thus, for an instrument where no warm-up time is specified, the sample would be tested immediately upon the instrument being powered on and then again after 1 hour.

The maximum allowable bias shift is ± 0.10 for the average of 5 readings.

GMM Checklist:
Warm-up Time. The following test procedures will be used to check warm-up times recommended by the manufacturer. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after turning the instrument power on.

The instrument will be powered off and stabilized at room temperature. The instrument will be powered on and after waiting the specified warm-up time, a single wheat sample (12% to 14% moisture content) will be analyzed 5 times. After waiting for a period of time equal to two times the manufacturer's suggested warm-up time, the sample will be analyzed 5 more times. The minimum waiting period before retesting the sample is one hour. Thus, for an instrument where no warm-up time is specified, the sample would be tested immediately upon the instrument being powered on and then again after 1 hour.

The maximum allowable bias shift is ± 0.20 % for the average of 5 readings.

9.d. Sample Temperature Sensitivity Test

Recommendation: Modify the first paragraph of the Sample Temperature Sensitivity Tests of the NIR and GMM Checklists respectively, as shown below, to improve consistency, to clarify the meaning, and to correct an error in the GMM checklist:

NIR Checklist:
II. Sample Temperature Sensitivity.

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus ΔT_H to room temperature minus ΔT_C, where ΔT_H is the magnitude of the manufacturer-specified maximum difference for grain above room temperature, and ΔT_C is the magnitude of the manufacturer-specified maximum difference for grain below room temperature. In no case will room temperature plus ΔT_H be allowed to exceed 45 °C, but ΔT_H need not equal ΔT_C. For purposes of these tests, room temperature will be defined as 22 °C ± 2 °C.

GMM Checklist:
II. Sample Temperature Sensitivity:

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. The sample temperature sensitivity test will be conducted using corn, HRW wheat, and soybean samples. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus ΔTH to room temperature minus ΔTC, where ΔTH is the magnitude of the manufacturer specified maximum difference for grain above room temperature and ΔTC is the magnitude of the manufacturer specified maximum difference for grain below room temperature. In no case will room temperature plus ΔTH be allowed to exceed 45 °C, but ΔTH need not equal ΔTC. For purposes of these tests, room temperature will be defined as 22 °C ± 2 °C

10. NTETC GMM/NIR Sector Support – Response to Sector's Letter to NCWM Chairman

Background: At the August 2002 meeting of the GMM and NIR Sectors, Don Onwiler, Nebraska Department of Agriculture, Division of Weights & Measures, representing the NCWM Board of Directors (BOD), informed the Sectors that the BOD believes that the major work of the GMM & NIR Sectors has been completed. The BOD questioned whether annual Sector meetings would be required in the future. Don pointed out that the GMM Sector contributes only $500 annually to NTEP. The BOD calculates the total staff costs associated with the GMM/NIR Sector is about $15,000. In an effort to reduce costs, the BOD has decided that public members will no longer receive funding for travel to attend the GMM/NIR Sector meetings.

The information that Don presented at the Sector meeting raised concerns among the sector members with the direction that NCWM, Inc. seems to be taking with regard to the GMM and NIR Sectors. Because of these concerns, Sector Chairman, Cassie Eigenmann-Pierson, DICKEY-john Corp., was urged to send a letter to Ross Andersen, NCWM BOD Chairman, to express the Sector's concerns, to request a breakdown of actual recent GMM/NIR Sector meeting costs, and to seek continued NCWM, Inc. support of future meetings. The letter was drafted and sent to Mr. Andersen in October 2002.

Discussion: Ross Andersen, NCWM Chairman, appeared at the Sector's August 2003 meeting to respond in person to the Sector's letter and to obtain feedback for the BOD to use in future planning. Ross said that the board understands the importance to commerce and the complexity of issues related to grain moisture meters and NIR grain analyzers. Equity in the system is a concern. He noted that the Sector's discussions relating to lack of alignment among meters seemed to indicate that the system was not resulting in the kind of equity expected. He recognized the importance of the Sector's work on standards, stating that when proper standards are met, the system will have uniformity. Unfortunately, the costs of supporting the Sector's activities exceed the income provided by the Sector. According to Ross, GMM/NIR Income and Expenses for the past 12 months resulted in a net loss of $9,831 as detailed below:

Income		
Based on five active CC's		**$1,425.00**
Expenses		
Meeting Costs include: Planning, Copies, Faxes, FedEx, refreshments, etc.	$715.00	
NCWM Publication 14 updates	$4,425.00	
Staff and Admin costs to support Sector	$5,703.00	
NCWM Funding (2002) for Travel to Sector Meeting	$413.00	
Total Expenses (past 12 months)		**$11,256.00**
Net Income (loss)		**($9,831.00)**

In the BOD's view, assignment of a single official moisture meter dampens competition, so it is unlikely that the number of CC's would ever increase to the point where Sector expenses are fully funded by CC fees.

The BOD suggested three options to make up the GMM/NIR Sectors' budget shortfall:

- **Option 1:** Determine the actual cost for NCWM to support this program annually and request funds from GIPSA, NIST, and the active NTEP Certificate holders to fund the difference between annual revenues and annual costs.

- **Option 2:** Determine the actual cost, divide this equally among the active NTEP Certificate holders, and increase the annual renewal fee to cover these costs.

- **Option 3:** Discontinue the administrative support of this device type under NTEP.

Options 1 and 2 received little or no support from the Sector. One manufacturer reported that their annual costs to participate in the program are approximately $25,000. Citing the proposed increase in manufacturers' costs for the on-going calibration program (from $3,600 to $5,300 per meter type per year), manufacturers were generally opposed to further increases. GIPSA and NIST representatives were skeptical that their agencies would be receptive to providing additional monetary support to NCWM. There was general agreement that the Sectors were within one to three meetings of being essentially "through" with changes to Publication 14. As an alternative to Sector meetings, it was suggested that NIST might host "technical sessions" where manufacturers, W&M personnel, and grain industry representatives could develop issues and recommendations to forward to the NCWM. One Sector member questioned the costs associated with the maintenance and printing of the GMM/NIR portion of Publication 14 noting that the material was developed and written by the Sector. The revenue received from the sale of this publication is less than $500 annually. It was suggested that it would be more economical to make the publication available at no charge on the Internet. Ross noted that the costs of updating NCWM Publication 14 should decrease as things become smoother in the system. In closing, Ross stated that NCWM's budget for next year includes an allowance for a GMM/NIR Sector meeting in August 2004.

11. Time and Place for Next Meeting

The next meeting is tentatively planned for the week of August 23, 2004, in the Kansas City, MO area. Meetings will be held in one of the meeting rooms at the National Weather Service Training Center if available. A tentative schedule is shown below.

Wednesday, August 25	10:00 am - 5:00 pm	GMM Sector Meeting
Thursday, August 26	8:00 am - 4:00 pm	NIR Grain Analyzer Sector Meeting

Items of interest to both Sectors will be considered in joint session either at the end of the first day or at the beginning of the second day depending on the final agenda.

National Type Evaluation Technical Committee (NTETC)
Near Infrared (NIR) Grain Analyzer Sector
August 21, 2002 - Kansas City, Missouri

Meeting Summary

Agenda:

★ 1. NTEP Committee Authorizes "Dual Certification"
★ 2. Recommended Changes to Publication 14 to Improve Consistency between GMM and NIR Checklists
★ 3. NTETC GMM/NIR Sector Support - Response to Sector's Letter to NCWM Chairman
★ 4. Time and Place for Next Meeting NIST/Office of Weights and Measures Reorganization
5. Report on the 2003 NCWM Annual Meeting – NIR Grain Analyzer Issues
6. NTEP Status Report - Recommended Change to Publication 14, Table 1
7. Recommended Change to Publication 14 – Accuracy
8. Recommended Changes and Additions to Publication 14
   a. Additional Printed Ticket Requirements
   b. Add Requirement for Calibrations to Be Clearly Distinguished from One Another
   c. Miscellaneous Editorial Changes
9. Forward-looking Issues

★ **Note**: Because of common interest, items marked with a star (★) were considered in a joint session of the NIR Grain Analyzer and the Grain Moisture Meter Sectors

---

1. NTEP Committee Authorizes "Dual Certification"

Discussion: The NTEP Committee reviewed the following recommendation during the 2003 NCWM Interim Meeting in Jacksonville, FL and accepted the Sector recommendation to issue a single Certificate of Conformance to a device that has been evaluated using two inter-related codes.

501-7 Grain Moisture Meter (GMM) and Near Infrared (NIR) Instruments Dual Certification
Source: GMM and NIR Sectors
Recommendation: The Sectors recommended that NCWM, Inc. authorize issuing a single CC for devices successfully type evaluated using two inter-related codes (e.g., a "Grain Moisture Meter CC with Near Infrared Grain Analyzer Certification" or, simply, "NIR Grain Analyzer with Dual Certification").

Steve Patoray, NTEP Director, outlined changes being considered for improvements in the database that NCWM maintains for CC's. In the improved database, devices would be classified first by a generic name and then by a secondary name or descriptor. For example, devices used to measure an attribute of grain, whether moisture or protein, would be classified generically as "grain analyzers." Proposed subclassifications under "grain analyzers" are: moisture only, moisture plus test weight, and multi-feature. A grain moisture meter successfully evaluated under both GMM and NIR Analyzer codes would be classified as Grain Analyzer/Multi-Feature

2. Recommended Changes to Publication 14 to Improve Consistency between GMM and NIR Checklists

Discussion: The NTEP Laboratory has pointed out discrepancies between the Near Infrared Grain Analyzer (NIR) and Grain Moisture Meter (GMM) checklists in Publication 14 for several similar tests. The following changes are suggested to improve consistency between the two checklists, to remove ambiguity, and to correct errors.

Conclusion: The Sector agreed to all of the following recommendations.

2.a. Power Supply Tests

Recommendation: Modify the Power Supply paragraphs of the "Type Evaluation Test Procedures and Tolerances" sections of the checklists for Near Infrared Grain Analyzers (NIR) and Grain Moisture Meters (GMM) respectively as shown below to improve consistency and to explicitly define the reference voltage:

NIR Checklist:
Power Supply. A single HRW wheat sample will be analyzed 10 times with the instrument operating at a voltage of 100 V. The voltage will be adjusted to 117 V. After 30 minutes, the HRW sample will be analyzed 10 times. The voltage level will then be increased to 130 V. After 30 minutes, the sample will be analyzed 10 more times.

Changes in bias and precision will be checked. Bias is defined as the change in the average protein for 10 analyses made at both the reference and the respective test voltages.

The maximum allowable bias change from the reference voltage (117 V) is ± 0.10. The maximum allowable standard deviation of 10 analyses (precision), at any of the three voltage levels, is 0.10.

GMM Checklist:
Power Supply. A single HRW wheat sample with a moisture content between 12 % and 14 % will be analyzed 10 times with the meter operating at a voltage of 100 V. The voltage will be adjusted to 117 V. After 30 minutes, the HRW sample will be analyzed 10 times. The voltage level will then be increased to 130 V. After 30 minutes, the sample will be analyzed 10 more times.

Changes in bias and precision will be checked. Bias is defined as the change in the average moisture for 10 analyses made at both the reference and the respective test voltages.

The maximum allowable bias change from the reference voltage (117 V) is ± 0.20 %. The maximum allowable standard deviation of 10 analyses (precision) at any of the three voltage levels is 0.10 %.

2.b. Leveling Tests

Recommendation: Remove the redundant first sentence of the Leveling Test of the NIR Checklist, and modify the wording of the tolerance sentence to specify that bias is calculated from the average of 5 readings. The proposed changes are shown below. [**Note**: the Leveling Test from the GMM Checklist is shown below for reference.]

NIR Checklist:
Leveling. The leveling test will be conducted for a minimum of 2 orientations, front-to-back and left-to-right, at a tilt of 5 %. Devices equipped with leveling indicators will be tested at the indicated limits of the level indicator rather than at a tilt of 5 %. Additional orientations will be tested as deemed appropriate.

The maximum allowable bias shift is ± 0.10 for the average of 5 readings.

GMM Checklist:
Leveling. Tests for leveling will be conducted using a single HRW wheat sample with a moisture content between 12 % and 14 %. The leveling test will be conducted for a minimum of 2 orientations, front-to-back and left-to-right, at a tilt of 5 %. Meters equipped with leveling indicators will be tested at the indicated limits of the level indicator rather than at a tilt of 5 %. Additional orientations will be tested as deemed appropriate.

The maximum allowable bias shift is ± 0.20 % for the average of 5 readings.

2.c. Warm-up Time Tests

Recommendation: Modify the Warm-up Time tests of the NIR and GMM Checklists respectively as shown below to improve consistency:

NIR Checklist:
Warm-up Time. The following test procedures will be used to check warm-up times recommended by the manufacturer. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after turning the instrument power on.

The instrument will be powered off and stabilized at room temperature. The instrument will be powered on and after waiting the specified warm-up time a single wheat sample will be analyzed 5 times. After waiting for a period of time equal to two times the manufacturer's suggested warm-up time, the sample will be analyzed 5 more times. The minimum waiting period before retesting the sample is one hour. Thus, for an instrument where no warm-up time is specified, the sample would be tested immediately upon the instrument being powered on and then again after 1 hour.

The maximum allowable bias shift is ± 0.10 for the average of 5 readings.

GMM Checklist:
Warm-up Time. The following test procedures will be used to check warm-up times recommended by the manufacturer. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after turning the instrument power on.

The instrument will be powered off and stabilized at room temperature. The instrument will be powered on and after waiting the specified warm-up time, a single wheat sample (12% to 14% moisture content) will be analyzed 5 times. After waiting for a period of time equal to two times the manufacturer's suggested warm-up time, the sample will be analyzed 5 more times. The minimum waiting period before retesting the sample is one hour. Thus, for an instrument where no warm-up time is specified, the sample would be tested immediately upon the instrument being powered on and then again after 1 hour.

The maximum allowable bias shift is ± 0.20 % for the average of 5 readings.

2.d. Sample Temperature Sensitivity Test

Recommendation: Modify the first paragraph of the Sample Temperature Sensitivity Tests of the NIR and GMM Checklists respectively, as shown below, to improve consistency, to clarify the meaning, and to correct an error in the GMM checklist:

NIR Checklist:
II. Sample Temperature Sensitivity.

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus ΔT_H to room temperature minus ΔT_C, where ΔT_H is the magnitude of the manufacturer-specified maximum difference for grain above room temperature, and ΔT_C is the magnitude of the manufacturer-specified maximum difference for grain below room temperature. In no case will room temperature plus ΔT_H be allowed to exceed 45 °C, but ΔT_H need not equal ΔT_C. For purposes of these tests, room temperature will be defined as 22 $^oC \pm 2\ ^oC$.

GMM Checklist:
II. Sample Temperature Sensitivity:

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. The sample temperature

sensitivity test will be conducted using corn, HRW wheat, and soybean samples. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus ΔT_H to room temperature minus ΔT_C, where ΔT_H is the magnitude of the manufacturer specified maximum difference for grain above room temperature and ΔT_C is the magnitude of the manufacturer specified maximum difference for grain below room temperature. In no case will room temperature plus ΔT_H be allowed to exceed 45 °C, but ΔT_H need not equal ΔT_C. For purposes of these tests, room temperature will be defined as 22 $^oC \pm 2\ ^oC$

3. NTETC GMM/NIR Sector Support - Response to Sector's Letter to NCWM Chairman

Background: At the August 2002 meeting of the GMM and NIR Sectors, Don Onwiler, Nebraska Department of Agriculture, Division of Weights & Measures, representing the NCWM Board of Directors (BOD), informed the Sectors that the BOD believes that the major work of the GMM & NIR Sectors has been completed. The BOD questioned whether annual Sector meetings would be required in the future. Don pointed out that the GMM Sector contributes only $500 annually to NTEP. The BOD calculates the total staff costs associated with the GMM/NIR Sector is about $15,000. In an effort to reduce costs, the BOD has decided that public members will no longer receive funding for travel to attend the GMM/NIR Sector meetings.

The information that Don presented at the Sector meeting raised concerns among the sector members with the direction that NCWM, Inc. seems to be taking with regard to the GMM and NIR Sectors. Because of these concerns, Sector Chairman, Cassie Eigenmann-Pierson, DICKEY-john Corp., was urged to send a letter to Ross Andersen, NCWM BOD Chairman, to express the Sector's concerns, to request a breakdown of actual recent GMM/NIR Sector meeting costs, and to seek continued NCWM, Inc. support of future meetings. The letter was drafted and sent to Mr. Andersen in October 2002.

Discussion: Ross Andersen, NCWM Chairman, appeared at the Sector's August 2003 meeting to respond in person to the Sector's letter and to obtain feedback for the BOD to use in future planning. Ross said that the board understands the importance to commerce and the complexity of issues related to grain moisture meters and NIR grain analyzers. Equity in the system is a concern. He noted that the Sector's discussions relating to lack of alignment among meters seemed to indicate that the system was not resulting in the kind of equity expected. He recognized the importance of the Sector's work on standards, stating that when proper standards are met, the system will have uniformity. Unfortunately, the costs of supporting the Sector's activities exceed the income provided by the Sector. According to Ross, GMM/NIR Income and Expenses for the past 12 months resulted in a net loss of $9,831 as detailed below:

Income		
Based on five active CC's		**$1,425.00**
Expenses		
Meeting Costs include: Planning, Copies, Faxes, FedEx, refreshments, etc.	$715.00	
NCWM Publication 14 updates	$4,425.00	
Staff and Admin costs to support Sector	$5,703.00	
NCWM Funding (2002) for Travel to Sector Meeting	$413.00	
Total Expenses (past 12 months)		**$11,256.00**
Net Income (loss)		**($9,831.00)**

In the BOD's view, assignment of a single official moisture meter dampens competition, so it is unlikely that the number of CC's would ever increase to the point where Sector expenses are fully funded by CC fees.

The BOD suggested three options to make up the GMM/NIR Sectors' budget shortfall:

- **Option 1:** Determine the actual cost for NCWM to support this program annually and request funds from GIPSA, NIST, and the active NTEP Certificate holders to fund the difference between annual revenues and annual costs.

- **Option 2:** Determine the actual cost, divide this equally among the active NTEP Certificate holders, and increase the annual renewal fee to cover these costs.

- **Option 3:** Discontinue the administrative support of this device type under NTEP.

Options 1 and 2 received little or no support from the Sector. One manufacturer reported that their annual costs to participate in the program are approximately $25,000. Citing the proposed increase in manufacturers' costs for the on-going calibration program (from $3,600 to $5,300 per meter type per year), manufacturers were generally opposed to further increases. GIPSA and NIST representatives were skeptical that their agencies would be receptive to providing additional monetary support to NCWM. There was general agreement that the Sectors were within one to three meetings of being essentially "through" with changes to Publication 14. As an alternative to Sector meetings, it was suggested that NIST might host "technical sessions" where manufacturers, W&M personnel, and grain industry representatives could develop issues and recommendations to forward to the NCWM. One Sector member questioned the costs associated with the maintenance and printing of the GMM/NIR portion of Publication 14 noting that the material was developed and written by the Sector. The revenue received from the sale of this publication is less than $500 annually. It was suggested that it would be more economical to make the publication available at no charge on the Internet. Ross noted that the costs of updating NCWM Publication 14 should decrease as things become smoother in the system. In closing, Ross stated that NCWM's budget for next year includes an allowance for a GMM/NIR Sector meeting in August 2004.

4. Time and Place for Next Meeting

The next meeting is tentatively planned for the week of August 23, 2004 in the Kansas City, MO area. Meetings will be held in one of the meeting rooms at the National Weather Service Training Center if available. A tentative schedule is shown below.

Wednesday, August 25	10:00 a.m. - 5:00 p.m.	GMM Sector Meeting
Thursday, August 26	8:00 a.m. - 4:00 p.m.	NIR Grain Analyzer Sector Meeting

Items of interest to both Sectors will be considered in joint session either at the end of the first day or at the beginning of the second day depending on the final agenda.

5. Report on the 2003 NCWM Interim and Annual Meetings

Background: Two items of interest to the NIR Sector were reviewed by the Committee on Specifications and Tolerances (S&T) at the NCWM Interim Meeting January 12-15, 2003:

357-1 S.1.1. Digital Indications and Recording Elements
Source: NIR Sector
Recommendation: Amend paragraph S.1.1. (c) of the NIR Analyzer Code to include specifications for recording the "native" constituent value and moisture value along with the converted results and the manually entered moisture basis; amend paragraph S.1.1.(e) to recognize the need for moisture basis in determining the constituent mass; and add new paragraph S.1.1. (h) to include a specification that requires the printed information be arranged in a consistent and unambiguous manner.

357-2 S.1.2. Selecting Grain Class and Constituent
Source: Carryover Item 357-1B (This item originated from the National Type Evaluation Technical Committee (NTETC) Near Infrared Grain Analyzer (NIR) Sector and first appeared on the Committee's 2002 agenda.)
Recommendation: Add new text to paragraph S.1.2. of the NIR Analyzer Code to address specialty crop transactions where industry is concerned about the proprietary nature of calibration information. This is the same wording recommended by the S&T Committee in the 2002 NCWM S&T Agenda Item 357-1B.

The S&T Committee forwarded these items as voting items for the 2003 Annual Meeting. For additional background refer to *Committee Reports for the 88th Annual Meeting,* NCWM Publication 16, April 2003.

Discussion: At the 88th Annual Meeting held July 13 – 18, 2003 the Conference voted to accept **Agenda Item 357-1** and **Agenda Item 357-2**. In a comment on Agenda Item 357-1, the NIST Weights and Measures Division recommended adding a definition for "native moisture basis." The Sector noted that a definition for "native moisture basis" already appears in §A.3 of the NIR Code:

> **A.3. Calibrations. -** The National Type Evaluation Program Certificate of Conformance (CC) shall indicate the native moisture basis of each calibration. The "native" moisture basis is the default moisture basis of the sealable constituent calibration (or constituent calibration pair when a non-displayed moisture calibration is also involved).

6. NTEP Status Report - Recommended Change to Publication 14, Table 1

Background: At the 87th Annual Meeting held July 14 – 18, 2002 the Conference voted to accept **Agenda Item 357-1A**, elevating the Near Infrared Grain Analyzer Code to permanent status, effective January 1, 2003. At its August 2002 meeting, the NIR Grain Analyzer Sector recommended significant changes to the NIR checklist of Publication 14, agreeing on tolerance values for sample temperature sensitivity, accuracy, precision, and reproducibility tests for barley protein; corn protein, oil, and starch; and soybean protein and oil [wheat protein tolerances had been approved at an earlier meeting]. A number of editorial changes were also agreed upon. The NTEP Committee, at the January 2003 NCWM Interim Meeting in Jacksonville, FL, accepted the Sector's recommendations. The recommendations were published in the 2003 Edition of Publication 14 paving the way for the NTEP laboratory to accept NIR Grain Analyzer instruments for type evaluation testing.

Discussion: Cathy Brenner, Grain Inspection, Processors and Stockyards Administration (GIPSA), NTEP Participating Laboratory for NIR Grain Analyzers, reported that one application had been received for type evaluation testing. She also reported that restrictive sample set requirements have made it difficult to assemble the necessary samples for testing, even where sample re-wetting is allowed. Sample selection has been especially difficult where multiple constituents are involved for a single product. Of particular concern is the Sample Temperature Sensitivity Test, which requires two sample sets for each grain type representing the low and high moisture ranges shown in Table 1 - Constituent Ranges for Type Evaluation. Each moisture set, in turn, consists of three samples, one from each of three constituent concentration ranges (the upper third, the middle third, and the lower third of the constituent concentration range for the grain type). Cathy suggested that the moisture ranges in Table 1 be expanded.

Conclusion/Recommendation: To facilitate sample selection for testing, the Sector accepted, by consensus, the recommended changes widening the low and high moisture ranges in Table 1 of the NIR Checklist in Publication 14 as shown below:

Table 1. Constituent Ranges for Type Evaluation

Grain Type	Constituent	Constituent Range (%) at Moisture Basis (M.B.) Shown	Low Moisture Range	High Moisture Range
Durum Wheat	Protein	10 - 18 at 12 % M.B.	10 % - 12 %	13 % - 15 %
Hard Red Spring Wheat	Protein	10 - 19 at 12 % M.B.		
Hard Red Winter Wheat	Protein	8 - 18 at 12 % M.B.		
Hard White Wheat	Protein	9 - 16 at 12 % M.B.		
Soft Red Winter Wheat	Protein	9 - 12 at 12 % M.B.		
Soft White Wheat	Protein	8 - 15 at 12 % M.B.		
"All Class" Wheat Calibration	Protein	8 - 19 at 12 % M.B.		
Two-rowed Barley	Protein	8 - 17 at 0 % M.B.	10 % - 12 %	13 % - 15 %
Six-rowed Barley	Protein	8 - 17 at 0 % M.B.		

Table 1. Constituent Ranges for Type Evaluation				
Grain Type	Constituent	Constituent Range (%) at Moisture Basis (M.B.) Shown	Low Moisture Range	High Moisture Range
"All Class" Barley Calibration	Protein	8 - 17 at 0 % M.B.	10 % - 12 %	13 % - 15 %
Corn	Protein	8 - 12 at 0 % M.B.	11 % - 13 %	14 % - 16 %
	Oil	3 - 9 at 0 % M.B.		
	Starch	67 - 73 at 0 % M.B		
Soybeans	Protein	30 - 40% at 13 % M.B.	10 % - 12 %	13 % - 15 %
	Oil	16 - 21% at 13 % M.B.		

7. Recommended Change to Publication 14 - Accuracy

Discussion: In the NIR Checklist in the 2003 Edition of Publication 14 there is a discrepancy between the text describing how accuracy is to be computed and the definitions for the parameters used in calculating accuracy. The text states, "The first replicate for each sample will be used to calculate the Standard Error of Performance (SEP) for each instrument with respect to the reference method." In contrast, the parameter x_i used in the calculation of SEP is defined as the *average* predicted concentration of the three replicates of each sample. In the June 2000 issue of Publication 14, both text and equations for calculating SEP are in agreement. The definitions of x_i and y_i in the NIR Checklist were mistakenly changed to agree with the definitions used in the GMM Checklist during editing of other changes in the NIR Checklist in preparation for the Sector's previous meeting.

Recommendation: The Sector recommended changing the Accuracy equations of the NIR Checklist of Publication 14 as shown below to agree with the text, which specifies that the SEP is calculated using only the first replicate of each sample. [Editor's Note: Changes/additions to the equations have NOT been highlighted or underlined. The MS change-tracking feature does not mark changes or additions made using MS Equation Editor.]

Accuracy. The first replicate for each sample will be used to calculate the Standard Error of Performance (SEP) for each instrument with respect to the reference method. Each instrument will be tested individually.

where, $$SEP = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \bar{y})^2}{n-1}}$$

~~$\bar{x}_i$~~ x_i = predicted constituent concentration for the first replicate of sample i

r_i = reference constituent concentration for sample i

~~$y_i = \bar{x}_i - r_i$~~ $y_i = x_i - r_i$

$\bar{y}$ = average of y_i

n = number of samples in the test set for the constituent calibration being evaluated
(n = 50, see Note 1 below regarding "all class" calibrations.)

8. Recommended Changes and Additions to Publication 14

Conclusions: The Sector agreed to the following changes to the checklist section of the NIR Grain Analyzer portion of NCWM Publication 14 to reflect recent additions/changes to NIST Handbook 44, Section 5.57. Near-Infrared Gain Analyzers. The Sector also agreed to the editorial changes discussed in Agenda Item 8.c.

8.a. Additional Printed Ticket Requirements

Recommendation: Change the NIR Grain Analyzer Checklist section of Publication 14 as shown below to reflect changes to NIST Handbook 44, Code Section S.1.1. (e) and the addition of Code Section S.1.1. (h). adopted at the 2003 NCWM Annual Meeting.

Code Reference: S.1.1. Digital Indications and Recording Elements

3.1.	The analyzer shall be equipped with a digital indicating element.	Yes ☐ No ☐ NA ☐
3.2.	The minimum height for digits used to display moisture is 10 mm.	Yes ☐ No ☐ NA ☐
3.3.	The analyzer is equipped with a communications interface that permits interfacing with a recording element and can transmit the date, grain type or class, constituent values, the moisture basis for each constituent value (except moisture), and calibration version identification. The printed ticket includes the "native" concentration and moisture basis in addition to the converted results and the manually entered moisture basis, if the analyzer is able to convert constituent results to a manually entered moisture basis.	Yes ☐ No ☐ NA ☐
3.4.	A digital indicating element shall not display, and recording element shall not record, any constituent value before the end of the measurement cycle.	Yes ☐ No ☐ NA ☐
3.5.	Constituent content is recorded and displayed as a percent of total mass at the specified moisture basis. The moisture basis is also displayed and recorded for each constituent content result (except moisture).	Yes ☐ No ☐ NA ☐
3.5.1.	If a whole grain analyzer that is calibrated to display results on an "as is" moisture basis does NOT display or record a moisture value, it clearly indicates that results are expressed on an "as is" moisture basis.	
3.5.2.	Ground grain analyzers must ALWAYS display and record a moisture measurement for "as is" content results (except moisture).	
3.6.	Digital and recording elements shall not display or record any constituent values beyond the operating range of the device unless the constituent value representation includes a clear error indication (and recorded error message with the recorded representation).	Yes ☐ No ☐ NA ☐
3.7	If an NIR analyzer is used to determine a moisture value, either to determine the moisture of an "as is" constituent content measurement or to convert from one moisture basis to another, the moisture measurement must be concurrent with the measurement of other constituents.	Yes ☐ No ☐ NA ☐
3.8	The information appearing on printouts of analyzers with built–in printers or accessory printers is arranged in a consistent and unambiguous manner.	Yes ☐ No ☐ NA ☐

8.b. Add Requirement for Calibrations to Be Clearly Distinguished from One Another

Recommendation: Add wording to the NIR Grain Analyzer Checklist section of Publication 14 as shown below to reflect changes to NIST Handbook 44, Code Section S.1.2. adopted at the NCWM 2003 Annual Meeting.

Code Reference: S.1.2. Selecting Grain Class and Constituent

3.9. The means to select the kind and class of grain type or class and constituent(s) shall be readily visible and the type or class of grain and constituents selected shall be clearly and definitely identified in letters (such as HRWW, HRWS, SWW, etc. or PROT, etc.) or with symbols clearly defined adjacent to the display. The device shall be capable of indicating grain type using a minimum of four characters. Calibrations are clearly distinguished from one another, if more than one calibration is included for a given grain type. Yes ☐ No ☐ NA ☐

8.c. Miscellaneous Editorial Changes

Discussion: Much of the NIR Grain Analyzer Checklist was developed by editing and modifying portions of the GMM Checklist. A review of the 2003 edition of the NIR Grain Analyzer Checklist revealed several instances where the word "moisture" was either not replaced by "protein" or "constituent" or "constituent value" or was not deleted. The changes proposed below are to correct this oversight.

Recommendations:

8.c.1. Replace "moisture" with "protein" in the last sentence of the Instrument Temperature Sensitivity Test as shown:

The maximum allowable protein bias will be ± 0.35 from the average protein measured at 22 °C.

8.c.2. Delete the word "moisture" from the paragraph referring to remote displays in Section 1. General.

1. General

Code Reference: G-S.1. Identification

As a practical matter, remote displays are not required to have serial numbers because they typically only repeat the information received from the measuring element. Similarly, external printers are not required to have serial numbers because they do not alter the information received from the measuring element.

8.c.3. Replace "moisture" with "constituent values" in NIR Checklist item 3.2. as shown:

3.2. The minimum height for digits used to display constituent values is 10 mm. Yes ☐ No ☐ NA ☐

8.c.4. Replace "moisture" with "constituent" in NIR Checklist item 3.9. as shown:

3.9 An analyzer shall automatically and clearly indicate when the constituent content operating range has been exceeded. Analyzers shall not display a constituent result when operating temperature ranges are exceeded. In both instances, a clear error indication is required. A 5 °C tolerance is applied to temperature ranges when testing to verify that constituent results are not displayed or printed when the temperature range is exceeded. Yes ☐ No ☐ NA ☐

8.c.5. Replace "moisture" with "constituent" and re-number items under **Code Reference: S.4. Operating Instructions and Use Limitations** as shown below:

Code Reference: S.4. Operating Instructions and Use Limitations

4.13. Operating instructions shall be furnished by the manufacturer with each device. Complete information concerning the accuracy, sensitivity, and use of accessory equipment necessary in obtaining a constituent content shall be included. Yes ☐ No ☐ NA ☐

In addition, operating instructions shall include the following information:

4.13.1. Name and address or trademark of the manufacturer. Yes ☐ No ☐ NA ☐

4.13.2. The type or design of the device with which it is intended to be used. Yes ☐ No ☐ NA ☐

4.13.3. Date of issue. Yes ☐ No ☐ NA ☐

4.13.4. The kind or classes of grain or seed for which the device is designed to measure constituent content. Yes ☐ No ☐ NA ☐

4.13.5. The limitations of use (e.g., constituent measurement range, grain or seed temperature, kind or class of grain or seed, instrument temperature, voltage and frequency ranges, electromagnetic interferences, and necessary accessory equipment). Yes ☐ No ☐ NA ☐

4.13.6. The appropriate user selectable options or settings for each calibration installed in the device. Yes ☐ No ☐ NA ☐

9. Forward-looking Issues

Discussion: Grain handling companies with multiple operating locations are increasingly interested in networking their NIR instruments to monitor performance, to ensure uniformity, and to facilitate simultaneous updating of calibration changes. The simplest networked systems utilize conventional NIR Grain Analyzer instruments with remote communication capability. When the CC holder issues new calibrations, they are transmitted simultaneously to all networked instruments. Type evaluation and field inspection of such devices can be identical to non-networked analyzers. Dr. Charles Hurburgh, Jr., Agricultural & Biosystems Engineering, Iowa State University, briefed the Sector on several emerging technologies with system configurations that may require new approaches to type evaluation and field inspection.

No resident calibration – For each sample measured, the instrument performs a local regression and develops a one-time-use calibration utilizing a "live" calibration database maintained off-site by an independent data service company. New calibration samples are added to the calibration database from time to time to make it more universally applicable.

All calculations performed off-site – The local instrument obtains optical data on the sample to be measured. Optical data is transmitted to an off-site computer that calculates the result and transmits the result back to the local instrument for display and print out. The off-site computer may use either a standard calibration or may develop a one-time-use calibration for each measurement as described above.

In both of the examples cited, the off-site data bank and computer may or may not be in the same jurisdiction as the local instrument.

On the surface, field inspection using standard samples would seem to be straightforward. However, with no fixed calibration on the local instrument and a changing database, the inspector has no way to insure that the instrument

will give the same result the next day, the next month, or at any time in the future. As a partial solution, the instrument could be required to have the ability to query the remote computer and display the version number of the calibration algorithm and perhaps a database issue date. Similarly, type evaluation accuracy tests and sample temperature sensitivity tests, which are calibration dependent, could be verified at only one point in time with no assurance that acceptable results would be obtained at any future time. Type evaluation would seem to require not only a test of the instrument's hardware, but also an evaluation of the calibration algorithm. If a "live" database is involved, evaluation becomes even more problematic. If the database can affect the indicated value, it would seem that the database is a metrologically significant element in the system. Even if the integrity of the database could be assured by an audited quality system, determining the effect of the introduction of new samples on the performance of the instrument under type evaluation conditions would seem to require re-testing every time new calibration samples are added to the database.

Conclusion: The Sector took no action on this issue

Appendix C

Measuring Sector Summary

October 3-4, 2003
Charlotte, North Carolina

1. Recommendations to Update to NCWM Publication 14 to Reflect Changes to NIST Handbook 44

Source: NIST/WMD

Background: The 88th National Conference on Weights and Measures (NCWM) adopted the following items that will be reflected in the 2004 Edition of NIST Handbook 44 and NCWM Publication 14. These agenda items are to inform the Measuring Sector of the NCWM actions and recommend changes to NCWM Publication 14.

Recommendation: The Sector reviewed the following recommended changes to Publication 14 based on changes to NIST Handbook 44:

A. G-S.1. Identification

During its 2003 Annual Meeting, the NCWM agreed to amend Handbook 44 General Code paragraph G-S.1. Identification as follows:

G-S.1. Identification. - All equipment, except weights and separate parts necessary to the measurement process, but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model designation that positively identifies the pattern or design of the device;

(c) the model designation shall be prefaced by the term "Model," "Type," or "Pattern." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod."
[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)

[Note: Prefix lettering may be initial capitals, all capitals or all lower case.]

(d) except for equipment with no moving or electronic component parts and not- built-for-purpose, software-based devices, a nonrepetitive serial number;
[Nonretroactive as of January 1, 1968]

(e) for not-built-for-purpose, software-based devices the current software version designation;

(f)~~(e)~~ the serial number shall be prefaced by words, an abbreviation, or a symbol that clearly identifies the number as the required serial number; and
[Nonretroactive as of January 1, 1986]

(g)~~(f)~~ the serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).
[Nonretroactive as of January 1, 2001]

(h)~~(g)~~ For devices that have an NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number, the NTEP CC shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device. (Amended 1985, 1991, 1999 and 2000)

Add new paragraph G-S.1.1. and renumber existing paragraph G-S.1.1. as follows:

G-S.1.1. Not-Built–For–Purpose Devices, Software-Based. - For not-built–for–purpose, software-based devices, the following shall apply:

(a) the manufacturer or distributor and the model designation shall be continuously displayed or marked on the device (see note below), or

(b) the Certificate of Conformance (CC) Number shall be continuously displayed or marked on the device (see note below), or

(c) all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) be continuously displayed. Alternatively, a clearly identified "view only" System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.

Note: Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.
[Nonretroactive as of January 1, 2004]

Amend Code Reference G-S.1. and add Code Reference G-S.1.1. in Section 1 on page LMD-9 of the Liquid-Measuring Devices Checklist and Test Procedures and Section 1 on page CLMD-2 of the Cryogenic Liquid-Measuring Devices Checklist and Test Procedures of NCWM Pulication14, Measuring Devices, 2003 edition as follows:

All equipment shall be clearly and permanently marked on an exterior surface that is visible after installation with the following information (prefix lettering may be initial capitals, all capitals, or all lower case):

1.1.	**Name, initials, or trademark of the manufacturer.**	**Yes ☐ No ☐ NA ☐**
1.1.1.	**The manufacturer's designation that positively identifies the pattern or design.**	**Yes ☐ No ☐ NA ☐**
1.1.2.	**The Model designation shall be prefaced by the word "Model", "Type", or "Pattern". These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, at a minimum, begin with the letter "N" (e.g., No or No.) The abbreviation for the word "Model" shall be "Mod" or "Mod.". Effective January 1, 2003).**	**Yes ☐ No ☐ NA ☐**
1.1.3.	**A unique serial number (except for not built-for-purpose, software-based devices.**	**Yes ☐ No ☐ NA ☐**
1.1.3.1	**The current software version number for not built-for-purpose, software-based devices**	**Yes ☐ No ☐ NA ☐**
1.1.4.	**The serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).**	**Yes ☐ No ☐ NA ☐**

Code Reference G-S.1. (g). Effective January 1, 2003

1.1.5. **The NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number for devices that have a CC. The number shall be prefaced by the terms "NTEP CC", "CC", or "Approval". These terms may be followed by the word "Number" or an abbreviation for the Word "Number". The abbreviation shall as a minimum begin with the letter "N" (e.g., No or No.).** **Yes ☐ No ☐ NA ☐**

The device must have an area, either on the identification plate or on the device itself, suitable for the application of the Certificate of Conformance Number. If the area for the CC Number is not part of an identification plate, note its intended location and how it will be applied.

Location of CC Number if not located with the identification:

_____

_____

Code Reference: G-S.1.1. Not Built-for-Purpose Devices, Software-Based

1.2. **For not built-for-purpose, software-based devices the following shall apply:**

1.2.1. **the manufacturer or distributor and the model designation shall be continuously displayed or marked on the device (see note below), or** **Yes ☐ No ☐ NA ☐**

1.2.2. **the Certificate of Conformance (CC) Number shall be continuously displayed or marked on the device (see note below), or** **Yes ☐ No ☐ NA ☐**

1.2.3. **all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) be continuously displayed. Alternatively, a clearly identified view only System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.** **Yes ☐ No ☐ NA ☐**

Note: **Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.**

1.~~2~~3. **The identification badge must be visible after installation.** **Yes ☐ No ☐ NA ☐**

1.~~3~~4. The identification badge must be permanent. **Yes ☐ No ☐ NA ☐**

Renumber succeeding paragraphs accordingly.

Amend Code Reference G-S.1. and add Code Reference G-S.1.1. in Section 1 on page ECRD-3 of the Electronic Cash Registers Interface with Retail Motor-Fuel Dispensers Checklist and Test Procedures of NCWM Pulication14, Measuring Devices, 2003 edition as follows:

B. Checklist and Test Procedure

1. Identification

Code Reference: G-S.1. General - **Each cash register must comply with the appropriate Handbook 44 identification requirements. All equipment, except weights and separate parts necessary to the**

measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information. (prefix lettering may be initial capitals, all capitals, or all lower case)

Location of the information:

1.1.	**The name, initials, or trademark of the manufacturer or distributor.**	**Yes ☐ No ☐ NA ☐**
1.2.	**A model designation that positively identifies the pattern or design of the device.**	**Yes ☐ No ☐ NA ☐**
1.3.	**The Model designation shall be prefaced by the word "Model", "Type", or "Pattern". These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, at a minimum, begin with the letter "N" (e.g., No or No.) The abbreviation for the word "Model" shall be "Mod" or "Mod.". (Effective January 1, 2003).**	**Yes ☐ No ☐ NA ☐**
1.4.	**Except for equipment with no moving or electronic component parts and not built-for-purpose, software-based devices, a nonrepetitive serial number.**	**Yes ☐ No ☐ NA ☐**
1.5.	**The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.**	**Yes ☐ No ☐ NA ☐**
1.6.	**The serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).**	**Yes ☐ No ☐ NA ☐**
1.7	**The current software designation for not built-for-purpose, software-based devices.**	**Yes ☐ No ☐ NA ☐**
1.~~7~~8.	**The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.**	**Yes ☐ No ☐ NA ☐**
1.~~8~~9.	**The device must be marked with a unique serial number to identify the electronic element that controls the system. A remote display is not required to have a serial number because it usually does not have any electronics to analyze the signal received from the measuring element. Similarly, other elements of a system, (e.g., a printer, keyboard, cash drawer etc.) which cannot be operated as stand-alone units or are not intended to interface in a system of other models are not required to have a serial number.**	**Yes ☐ No ☐ NA ☐**

Code Reference G-S.1. (g). Effective January 1, 2003

1.~~9~~10.	**The NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number for devices that have (or will have) a CC. The number shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the word "Number" or an abbreviation for the word "Number." The abbreviation shall as a minimum begin with the letter "N" (e.g., No or No.).**	**Yes ☐ No ☐ NA ☐**

The device must have an area, either on the identification plate or on the device itself, suitable for the application of the Certificate of Conformance Number. If the area for the CC number is not part of an identification plate, note its intended location and how it will be applied.

Location of CC Number if not located with the identification information:

_____

_____

The marking must be visible after installation.

~~**1.10. The serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).**~~ ~~**Yes ☐ No ☐ NA ☐**~~

1.11. Equipment is to be marked on a surface that is an integral part of the chassis, which is visible after installation. If the required information is located on the back of the device, the same information must also appear on the side, front, or top. It may be installed on the housing only if the housing can be fitted with a security seal. The bottom of a device is not an acceptable surface. **Yes ☐ No ☐ NA ☐**

1.12. The marking must be permanent. It may be a metal or plastic plate attached with pop rivets, adhesive, or other means. Removable bolts or screws are not permitted. A foil plate may be used provided it is destroyed in any attempt to remove it. Additionally, the printing on a foil plate must be easily read and not easily obliterated by rubbing with a relatively soft object (e.g., the wood of a pencil). **Yes ☐ No ☐ NA ☐**

Code Reference: G-S.1.1. Not Built-for-Purpose Devices, Software-Based

1.13. For not built-for-purpose, software-based devices the following shall apply:

1.1.3.1. the manufacturer or distributor and the model designation shall be continuously displayed or marked on the device (see note below), or **Yes ☐ No ☐ NA ☐**

1.13.2. the Certificate of Conformance (CC) Number shall be continuously displayed or marked on the device (see note below), or **Yes ☐ No ☐ NA ☐**

1.13.3. all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) be continuously displayed. Alternatively, a clearly identified view only System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated. **Yes ☐ No ☐ NA ☐**

Note: Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.

B. S.4.4.1. Discharge Rates

Background: During its 2003 Annual Meeting, the NCWM agreed to amend Handbook 44 General Code paragraph S.4.4.1. Discharge Rates as follows:

S.4.4.1. Discharge Rates. - On a retail device with a designed maximum discharge rate of 115 L (30 gal) per minute or greater, the maximum and minimum discharge rates shall be marked ~~on an exterior surface of the device and shall be visible after installation~~ in accordance with S.4.4.2. The marked minimum discharge rate shall not exceed 20 % of the marked maximum discharge rate.

Example: With a marked maximum discharge rate of 230 L/min (60 gpm), the marked minimum discharge rate shall be 45 L/min (12 gpm) or less (e.g., 40 L/min (10 gpm) is acceptable). A marked minimum discharge rate greater than 45 L/min (12 gpm) (e.g., 60 L/min (15 gpm)) is not acceptable.

Recommendation: Modify Section 11, paragraph 11.2. of the Liquid-Measuring Devices Checklist and Test Procedures of NCWM Pulication14, Measuring Devices, 2003 edition as follows:

Code Reference: S.4.4. Marking Requirements For Retail Devices Only

11.2. On a retail device with a designed maximum discharge rate of 115 L/min (30 gpm) or greater, the maximum and minimum discharge rates shall be marked ~~on an exterior surface of the device and be visible after installation~~ in accordance with S.4.4.2. The minimum rate shall not exceed 20 % of the maximum discharge rate. **Yes ☐ No ☐ NA ☐**

Example: With a marked maximum discharge rate of 230 L/min (60 gpm), the marked minimum discharge rate shall be 45 L/min (12 gpm) or less (e.g., 40 L/min (10 gpm) is acceptable). A marked minimum discharge rate greater than 45 L/min (12 gpm) (e.g., 60 L/min (15 gpm)) is not acceptable.

Discussion/Conclusion: At the October 2003 NTETC Measuring Sector Meeting, there was no discussion on these items. The Sector recommends that the NTEP Committee amend Publication 14, as shown above.

2. Testing Required for an Electronic Indicator with a CC Interfaced with a Measuring Element with a CC not Previously Evaluated Together (Carry-Over Item)

Source: NTEP Measuring Laboratories

Background: At the May 2001 NTEP Laboratory Meeting, one of the participating laboratories asked for input regarding what testing should be required if the manufacturer of an indicator wanted the CC to recognize the indicator for use with different types of measuring devices, such as PD meters, turbine meters, and mass flow meters. Dan Reiswig (CA NTEP Laboratory) agreed to provide a draft of changes to the Liquid-Measuring Devices Checklist and Procedures that included requirements for indicators intended to be used with more than one device type.

Dan Reiswig was not able to attend the September 2001 Measuring Sector Meeting. The Sector agreed to carry this item forward on next meeting's agenda. The following groups and individuals agreed to provide input: the NTEP Measuring Laboratories, Measurement Canada, Rich Tucker (Tokhiem representing GPMA), John Skuce (FMC – Smith Meter representing MMA), Mike Keilty (Micro Motion), and David Hoffman (Toptech).

At the June 2002 NTEP Laboratory Meeting, the laboratories agreed that an initial performance test conducted by an approved NTEP Laboratory is required. The testing criteria applied should be the same as that applied to a new metering system. Subsequent permanence testing should be at the discretion of NTEP based on the initial performance and could be conducted by a local weights and measures official under the direction and control of the NTEP evaluator performing the initial test.

Prior to the 2002 NTEP Laboratory Meeting Rich Tucker (Tokhiem representing GPMA) submitted the following for consideration by the labs:

- **Testing Required for an Electronic Indicator with a CC Interfaced with a Measuring Element with a CC not previously Evaluated Together.**

- **Significant Assumptions**

The metering element has been through NTEP so all the accuracy, permanence, and flow rate information has been tested and meets all requirements of Handbook 44.

The Electronic Indicator has been through NTEP and all electronic functions and other requirements have been tested and meet all requirements of Handbook 44.

For the Dispenser, the manufacturer can only request flow rates that fall within the meter approval flow limits and products.

In the above scenario, the only open issue is the electronic interface to the pulser and the electronic calculator. The electronic calculator receives pulses directly from the pulser. The calculator converts the pulses into a volume by knowing how many pulses make up a gallon of delivery. For example, Tokheim uses, almost exclusively1000 pulses per gallon of delivery. This is not a standard. Other manufacturers use other pulse counts. The only verification is to make sure the manufacturer has setup the software correctly to match the pulser output and meter delivery.

Test
Run calibration test drafts to verify compatibility

Testing Options (The manufacturer at its option should do the following)
Have a representative from the NTEP go to a test site or the manufacturer's lab to verify compatibility. The manufacturer shall submit data from its lab testing and follow-up test data from an initial verification at one of the first installed sites. Data supplied would be a copy of the weights and measures calibration tests performed at the time the equipment was placed in service.

At the 2002 Sector Meeting a work group was formed to address this issue. The Sector agreed to consider the recommendations of that work group at its 2003 Meeting.

Randy Byrtus provided a summary of the Canadian policy to the work group as follows:

Section 10.(1) of the Canadian Weights and Measures Regulations prescribes that a device or class, type or design of device is exempt from paragraph 8(a) of the Weights and Measures Act if every part of the device that can have an effect on the accuracy of the device or class, type or design of device is approved pursuant to section 3 of the Act. Section 8(a) of the W&M Act simply states "that no trader shall use, or have in his possession for use, in trade, any device unless that device or class, type or design of device has been approved for use in trade pursuant to section 3." And section 3 prescribes that "the Minister shall, in accordance with the regulations, approve devices or classes, types or designs of devices for use in trade." In other words, if a register has its own approval and a meter has its own approval, it is possible to connect the two for trade use without having to approve the combination as a system.

Employing section 10.1is still at the discretion of the W&M inspector and the ASL. If there is any doubt that two or more approved devices when connected together are not compatible, the system can be subjected to an approval evaluation.

The aspect of assessing compatibility is usually performed at the initial field inspection. This is a post approval process. Before each and every device can be placed in service, it must undergo an initial inspection against requirements for installation and use of the device. It is frequently at this stage that approved registers and meters are connected to one another and presented for inspection. Compatibility is judged by whether or not the two devices perform accurately together within prescribed tolerances when subjected to the inspection process. If there is any doubt or evidence that the combination of approved devices is not compatible, they would not receive the initial inspection that is necessary to permit use-in-trade applications.

If the approval applicant at the time of approval requests that a certain individual device such as an electronic register can be used with approved volumetric meters that have different types of output signals, then the register is evaluated for each

type of signal input. This is typically done by simulating the type of input to the register. It is not necessary for the approval applicant to provide all the different meters unless the output signal from the meter cannot be simulated in the laboratory or there is some mechanical interface between the register and meter that could produce wear, cause alignment, and torque problems, etc.

In most instances when a volumetric meter is matched with an electronic register, they are connected electrically using wiring, buses or other digital interfaces. The main types of signal communication between meters and registers are square wave pulse form, high frequency pulse form, digital signal (i.e., bits and bytes) and current loop (i.e., 4mA to 20 mA). Current loop, although previously very prevalent, is seldom used today. The ASL can evaluate square wave pulse and high frequency forms using "built in-house" pulse generators. These are custom made to accommodate testing against the requirements for pulsers prescribed by *SVM-1, Ministerial Specifications for Electronic Registers.* These requirements were developed around the type of pulse generators that were prevalent before digital communication became popular. The SVM-1 applies to pulsers of the reed switch, hall-effect and photo-electric types. There are currently no requirements for digital-type outputs and there is presently no consideration for developing any because of the reliability of this form of communication over pulse-generated signals and their ability to check and monitor for complete data transfer and perform diagnostics. If digital communication is available for input to a register, the ASL will request a sample of an approved meter with digital capability in order to connect the register and meter together. This will determine if the register can accept and function properly with this type of communication. If, in the event the approval applicant cannot supply a meter, a means to simulate the input would be requested. Typically the compatibility of the system is flow tested at various flow rates over the range of the meter's rated capacity, the 4 mA to 20 mA signal is verified using a current supply and multimeter and checking the accuracy at different points between 4 mA and 20 mA. Naturally, certified and traceable measurement standards are used. Regardless of the type of signal generation, each type is evaluated at reference conditions as well as at ambient temperatures of -30 °C and +40°C. Under each of these conditions, the devices are exposed to radio frequency interference of 25 Mhz and 460 Mhz using 4-watt radio transceivers.

In all cases, regardless of the type of signal being used, many of the problems that affect the compatibility of devices are installation related due to incorrect wiring, lack of shielding, vibration, electromagnetic and radio frequency interference, incorrect configuration or selection of parameters when setting the device up, mismatched communication protocols and interfaces, and other installation effects that can cause compatibility problems.

Because there are no moving parts as there are in many type of volumetric metering devices that are subject to wear resulting in the degradation of accuracy, the ASL does not perform any permanency testing on registers. Our position is that electronic components either work or they don't work. There are rare instances that show noticeable degradation of accuracy over time due to electrically generated signals or aging electronic components.

When a Notice of Approval is issued for a volumetric meter or electronic register, the approval will identify which meter outputs are approved and which types of inputs are approved for the electronic register. The approval will also state that volumetric meters can be used with any approved and compatible electronic register and vice versa. Again, the compatibility aspect is judged at the installation during the initial inspection. If the approval for the meter and register identify like outputs/inputs, then the system proceeds with an inspection and is subject to subsequent re-inspections at later time intervals. The advantage of subsequent re-inspections is that they ensure continued compliance with applicable requirements as well as maintaining the compatibility aspect.

The work group submitted the following proposal to add a new paragraph N.X. only to Handbook 44 Section 3.30.. 3.31., 3.32. and 3.37. and an alternate proposal to add a new Section T. to Publication 14, for consideration at the 2003 Measuring Sector Meeting. The work group proposal included a new section 44 to be added to the Liquid-Measuring Devices Checklist and Test Procedures of Publication 14, 2003 Edition.

Recommendation: Add a new paragraph N.X. to Handbook 44 Sections 3.30. Liquid-Measuring Devices, 3.31. Vehicle-Tank Meters, 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices, and 3.37. Mass Flow Meters as follows:

N.X. Testing Required for an Electronic Indicator with a CC Interfaced with a Measuring Element with a CC not Previously Evaluated Together.

Additional testing by an NTEP authorized laboratory is not required if an electronic indicator with a CC is interfaced to a measuring element with a CC provided all of the following conditions are determined during the initial field verification:

(a) each device is used within the application limits noted on its CC;
(b) the devices are communicating with each other, and the system into which they are installed can be accurately calibrated;
(c) NTEP-compliant tickets (if required) can be printed from the system; and
(d) If a measuring device uses a 4 mA to 20 mA or frequency interface to transmit a fault signal, this interface is only interchangeable as defined by the measuring device CC.

Alternatively, add a new Section T to Publication 14, Technical Policy for Liquid-Measuring Devices and revise the Compatibility Test, 2003 edition as follows:

T. Testing Required for an Electronic Indicator with a CC Interfaced with a Measuring Element with a CC not Previously Evaluated Together.

Additional testing by an NTEP-authorized laboratory is not required if an electronic indicator with a CC is interfaced to a measuring element with a CC provided all of the following are true:

(a) each device is used within the application limits noted on its CC;
(b) the devices are communicating with each other, and the system into which they are installed can be accurately calibrated;
(c) NTEP-compliant tickets (if required) can be printed from the system, and
(d) If a measuring device uses a 4 mA to 20 mA or frequency interface to transmit a fault signal, this interface is only interchangeable as defined by the measuring device CC.

Compatibility Test:

~~Similar d~~Devices that were individually tested ~~for a similar application~~ can be "mixed and matched" without additional testing if the system functions properly during the initial routine field test as required by Section T of the Technical Policy for Liquid-Measuring Devices. For example, inspectors can determine the compatibility of an approved console interfaced with an approved retail motor-fuel dispenser during a field evaluation when both components are previously approved ~~in like~~ for the application~~s~~*. If devices are to be used in ~~dissimilar~~ new applications, then additional NTEP testing is required.

*Where "application" is as defined on the individual CC (e.g., stationary use only).

Add the following Additional Checklist and Test Procedures for Interfacing Components to Publication 14, 2003 edition.

44. Additional Checklist and Test Procedures for Interfacing Components

When examining the interface between Electronic Indicator and a Measuring Element, the following must be considered:

44.1	**Does the electronic indicator have a CC?**	**Yes** ☐	**No** ☐
44.2	**Is the electronic indicator being used within the application limits of the CC?**	**Yes** ☐	**No** ☐
44.3	**Does the measuring element have a CC?**	**Yes** ☐	**No** ☐
44.4	**Is the measuring element being used within the application limits of the CC?**	**Yes** ☐	**No** ☐
44.5	**Can the system into which both devices are installed be accurately calibrated?**	**Yes** ☐	**No** ☐

44.6	**Can a ticket (if required) be properly printed?**	**Yes** ☐	**No** ☐
44.7	**Are interfaces, other than mechanical or pulse interfaces (e.g., 4 mA to 20 mA or frequency interfaces), being used as defined by the appropriate CC?**	**Yes** ☐	**No** ☐

Discussion/Conclusion At the October 2003 Meeting, Richard Miller (FMC Measurement solutions) stated that his company has always been able to connect a loading- rack controller to a variety of measuring elements without NTEP having tested them for compatibility and/or listing them on the CC for the controller. Charlene Numrych (Liquid Controls) asked Randy Byrtus (Measurement Canada) if he was aware of a case where two components were interfaced and initially communicated correctly, then later failed to work correctly due to communication problems. Randy indicated that he was not aware of any such situation. One of the NTEP laboratories indicated that the reference to "NTEP compliant" in requirement (c), of the proposed language for addition to Handbook 44 tickets, was incorrect. Printed tickets or receipts need to comply with requirements in Handbook 44. The lab suggested that the "application limits" in requirement (a) of the proposed language for addition to Handbook 44 be specified. Charlene agreed to develop revised language for the proposal and forward it to the technical advisor for completion in time for the group to consider the revisions. The item was re-visited and the Sector agreed to forward the following Proposal 1 for addition to Publication 14 to the NCWM NTEP Committee for consideration, and the following Proposal 2 to the NCWM S&T Committee for consideration. The Sector strongly believes that, for the benefit of weights and measures officials, the proposed test notes for determining the compatibility of the various components of a weighing or measuring system need to be added to the General Code Section of Handbook 44.

Proposal 1. Add a new section "T" to Publication 14 to guide NTEP inspectors as to when additional testing is necessary to determine compatibility between components as follows:

Testing Required to Interface Components with Individual CC's that were Not Previously Tested Together.

Additional testing by an NTEP participating laboratory is not required if an electronic indicator is interfaced to a measuring element provided all of the following are true:

- **a) The communication means for the input to the electronic indicator (pulse, frequency, serial, etc.) has been previously tested with a measuring element listed on a CC;**
- **b) The communication means for the output of the measuring element (pulse, frequency, serial, etc.) has been previously tested with an electronic indicator listed on a CC;**
- **c) The communication means to be used for the electronic indicator input is the same as the communication means to be used for the measuring element output (pulse-pulse, frequency-frequency, serial-serial, etc.) and both devices are being used within the current parameters listed on their respective CCs;**
- **d) The devices are communicating with each other, and the system into which they are installed can be accurately calibrated; and**
- **e) If required, Handbook 44 compliant tickets can be printed.**

Note: NTEP may require initial or complete evaluation of new technologies or applications.

Add additional checklist section 44 to Publication 14 as follows:

44. Additional Checklist and Test Procedures for Interfacing Components

When examining the interface between Electronic Indicator and a Measuring Element, the following must be considered:

44.1	**Does the electronic indicator have a CC?**	**Yes** ☐	**No** ☐
44.2	**Is the electronic indicator being used within the application limits of the CC?**	**Yes** ☐	**No** ☐

44.3	**Does the measuring element have a CC?**	**Yes** ☐	**No** ☐
44.4	**Is the measuring element being used within the application limits of the CC?**	**Yes** ☐	**No** ☐
44.5	**Can the system into which both devices are installed be accurately calibrated?**	**Yes** ☐	**No** ☐
44.6	**Can a ticket (if required) be properly printed?**	**Yes** ☐	**No** ☐
44.7	**Are interfaces, other than mechanical or pulse interfaces (e.g., 4 mA to 20 mA or frequency interfaces), being used as defined by the appropriate CC?**	**Yes** ☐	**No** ☐

Proposal 2. Add a new paragraph G-N.3. Compatibility of Indicators and Weighing or Measuring Elements to Handbook 44 to clarify what requirements must be met to interface an indicating element and a weighing or measuring element that have not been previously evaluated together on a single NTEP Certificate of Conformance (CC), but each have its own NTEP CC listing compatible communication specifications.

G-N.3. Compatibility of Indicators and Weighing or Measuring Elements. – To be considered compatible, the following conditions shall be met:

(a) The communication means used for the input to the electronic indicator (analog, digital, pulse, frequency, serial, etc.) has been previously evaluated with a weighing or measuring element;

(b) The communication means used for the output of the weighing or measuring element (analog, digital, pulse, frequency, serial, etc.) has been previously evaluated with an electronic indicator;

(c) The communication means used for the electronic indicator input is the same as the communication means used for the weighing and measuring element output (analog-analog, digital-digital, pulse-pulse, frequency-frequency, serial-serial, etc.);

(d) The elements are communicating with each other, and the device or system into which they are installed can be accurately calibrated; and

(e) If required, Handbook 44-compliant tickets can be printed.

3. On-Screen Display of G.S.1. Requirements for Software-Based Built-for-Purpose Devices (New Item)

Source: NCWM S&T Committee

Background: At its 2003 Annual Meeting, the NCWM adopted a proposal that provides alternate methods other than physical marking for meeting some of the requirements in Handbook 44 G-S.1. for "not-built-for-purpose" devices. At that meeting the NCWM S&T Committee also reviewed an SMA proposal that provides similar alternate marking methods for "built-for-purpose" devices. The S&T Committee concluded that the proposal for "built-for-purpose" devices required further review and development by the NTETC Technical Sectors and the regional weights and measures associations.

Prior to the October 2003 NTETC Measuring Sector Meeting, the WMD NTETC technical advisors developed the alternate proposal shown above to modify G.S.1. and add a Table G.S.1. that provides alternate methods other than physical markings for meeting some of the requirements of G-S.1. for both "not-built-for-purpose" and "built-for-purpose" devices.

Recommendation: Modify Handbook 44 Section 1.10 General Code paragraph G-S.1. Identification, deleting paragraph G-S.1.1., renumbering paragraph G-S.1.2., and adding Table G-S.1. as follows:

G-S.1. Identification. - All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly marked in accordance with Table G-S.1. for the purposes of identification, with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model designation that positively identifies the pattern or design of the device;

(c) ***the model designation shall be prefaced by the term "Model," "Type," or "Pattern." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod."***
[Nonretroactive January 1, 2003]
(Added 2000) (Amended 2001)

[Note: Prefix lettering may be initial capitals, all capitals or all lower case.]

(d) except for equipment with no moving or electronic component parts and not built-for-purpose, microprocessor-based devices, a nonrepetitive serial number;
[Nonretroactive as of January 1, 1968]

(e) for microprocessor-based devices the current software designation or revision number;

(f) the serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number; and
[Nonretroactive as of January 1, 1986]

(g) the serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).
[Nonretroactive as of January 1, 2001]

(h) For devices that have an NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number, the NTEP CC shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.
(Amended 1985, 1991, 1999, 2000 and 200X)

Table G-S.1. Identification		
	Built-for-Purpose Instruments, Elements, or Systems	**Not Built-for-Purpose Instruments, Elements, or Systems**
Name, initials, or trademark of the manufacture or distributor	**M**	**DC[2] or DA**
Model designation[1]	**M[1]**	**DC[2] or DA**
Specific model designation[1]	**M, DC, or DA**	
Serial number	**M**	**Not required**
Revision number or Software Version number	**DC or DA**	**DC or DA**
Certificate of Conformance (CC) number	**M, DC, or DA**	**DC[2], DA,**

M: **Physically and permanently marked**

DC: **Continuously displayed**

DA: **Displayed by accessing a clearly identified "view only" System Identification, G-S.1. Identification, or Weights and Measures Identification accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.**

Note 1: **As a minimum, the model designation (positively identifying the pattern, design, type, series, generic, or trademark designation) must be marked on the device. If the model designation changes with differing parameters such as size, features, options, intended application, not Handbook 44 compliant, construction, etc., the specific model designation shall be physically marked or continuously displayed or be capable of being displayed.**

Note 2: **As a minimum, either the manufacturer or distributor and the model designation, or the CC Number shall be continuously displayed ~~or marked on the device~~. Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC, which may be available as an unaltered copy of the CC printed by the device or through another on-site device.**

Discussion/Conclusion: The Sector agreed with the WMD proposal in principle, but recommended some small changes to simplify the table. The Sector agreed to forward the following proposal for G-S.1. in tabular format as modified at the meeting to the NCWM S&T Committee for consideration.

Modify Handbook 44 Section 1.10 General Code paragraph G-S.1. Identification and add Table G-S.1. as follows:

G-S.1. Identification. - All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly marked <u>in accordance with Table G-S.1</u>. for the purposes of identification, with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model designation that positively identifies the pattern or design of the device;

(c) ***the model designation shall be prefaced by the term "Model," "Type," or "Pattern." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod."***
[Nonretroactive January 1, 2003]
(Added 2000) (Amended 2001)

[Note: Prefix lettering may be initial capitals, all capitals or all lower case.]

(d) except for equipment with no moving or electronic component parts and not-built-for-purpose, <u>microprocessor</u>-based devices, a nonrepetitive serial number;
[Nonretroactive as of January 1, 1968]

(e) for microprocessor-based devices the current software designation or revision number;

(f) the serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number; and
[Nonretroactive as of January 1, 1986]

(g) the serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).
[Nonretroactive as of January 1, 2001]

(h) For devices that have an NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number, the NTEP CC shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.
(Amended 1985, 1991, 1999, 2000 and 200X)

4. Tolerance for Product Depletion Test (Carry-Over Item)

Table G-S.1. Identification

	Built-for-Purpose Instruments, Elements, or Systems	Not Built-for-Purpose Instruments, Elements, or Systems
Name, initials, or trademark of the manufacturer or distributor	M	D[2]
Model designation	M[1]	D[2]
Specific model designation	M[1] or D	
Serial number	M	Not required
Revision number or software version number	Not Required	D
Certificate of Conformance (CC) number	M or D	D[2]

M: Physically and permanently marked

D: Either: (1) displayed by accessing a clearly identified "view only" System Identification, G-S.1. Identification, or Weights and Measures Identification accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated, or (2) continuously displayed. Note: ***For revision or software version number, clear instructions for accessing this information shall be listed on the CC in lieu of the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same or subsequent type that was evaluated.***

Note 1: As a minimum, the model designation (positively identifying the pattern, design, type, series, generic, or trademark designation) must be marked on the device. If the model designation changes with differing parameters such as size, features, options, intended application, not Handbook 44 compliant, construction, etc., the specific model designation shall be physically marked or continuously displayed or be capable of being displayed.

Note 2: As a minimum, either the manufacturer or distributor and the model designation, or the CC Number shall be continuously displayed. Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC, which may be available as an unaltered copy of the CC printed by the device or through another on-site device.

(Nonretroactive and effective 2005)

Source: Carry-Over Item

Background: At the September 2001 Measuring Sector Meeting there was a discussion of agenda item 5 comparing single-compartment testing to split-compartment testing. A member suggested that it would be appropriate to have separate tolerances for a product depletion test. The Sector agreed to discuss that as a separate agenda item if time permitted. During further discussion of the need for specific tolerances for a product depletion test, a member pointed out that the present criteria is affected by the test draft size. It is possible for a meter to fail at particular draft size; and by sufficiently increasing the draft size for a subsequent test, the same meter could pass without any repairs or adjustments being made. Ross Andersen (NY) indicated that NEWMA had developed a proposal to the tolerance for a product depletion test on the rated maximum flow rate for the meter. That proposal was not available for review. The Sector agreed to include the discussion of a product depletion test tolerance on the agenda for the next Sector meeting. Ross Andersen agreed to prepare a proposal for Sector consideration at that meeting.

Since the 2001 meeting New York has begun a study to compare the results of a product depletion test conducted on the same meter using different size provers. Mr. Andersen was to update the Sector at its 2002 Meeting on the progress of the study and to provide guidance to the Sector on how to proceed.

Mr. Andersen was unable to attend the 2002 Sector meeting. The Sector did review the proposal from NEWMA to modify N.4.2. and to add new paragraphs N.4.5. and T.5. shown below. Several Sector members disagreed with the NEWMA proposal for a tolerance based on a one minute flow at the maximum flow rate for the device under test. The Sector believes that the allowable error for a product depletion test should not be dependent on the size of the test draft. The Sector agreed that the item should be carried over to the agenda for the next Sector meeting to allow time for completion of the study being conducted by New York.

Discussion: The following proposal to modify N.4.2. Special Tests (except Milk Metering Systems) and add a new paragraph N.2.5. Product Depletion Test was forwarded to the NCWM S&T from the Northeastern Weights and Measures Association (NEWMA).

N.4.2. - Special Tests (except Milk Metering Systems). "Special" tests shall be made to develop the operating characteristics of a measuring system and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. or N.4.5. shall be considered a special test. Special test of a measuring system shall be made as follows:

(a) at a minimum discharge rate of 20 % of the marked maximum discharge rate or at the minimum rate marked on the device whichever is less,

(b) to develop operating characteristics of the measuring system ~~during a split-compartment delivery~~. (Amended 1978)

N.4.5. Product Depletion Test - The effectiveness of the vapor eliminator shall be tested by depleting the product supply and continuing the test until the lack of fluid causes the meter register to stop absolutely. The test shall be completed by switching to another compartment with sufficient product on a multi-compartment vehicle or by adding sufficient product to a single-compartment vehicle. When adding product to a single-compartment vehicle, allow appropriate time for any entrapped vapor to disperse before continuing the test.

T.5. Product Depletion Test – The difference between the results of the normal test and the product depletion test shall not exceed 0.5 % of the equivalent of one minute of flow at the maximum rated flow rate for the system.

WMD provided information to the Sector showing that in 1974 the NCWM S&T Committee developed a proposal to amend the split-compartment test tolerance to be based on the manufacturer's maximum flow rate rather than on the size of the prover used during the test. The item was adopted by the NCWM but apparently Handbook 44 was never amended to reflect the change. The following was excerpted from the 1974 Final Report of the NCWM S&T Committee:

CODE FOR VEHICLE TANK METERS

1. Split-Compartment Test Tolerances. - Over the last several years, the committee has received numerous comments that the tolerances applicable when conducting a split-compartment test on a vehicle-tank meter are impractical. The existing tolerances are based on the capacity of the prover used in the test; however, the error resulting from this test is not a function of prover capacity but rather it is related to the rate of flow and the system itself. The committee agrees with these comments and recommends changing these tolerances by amending the Vehicle-Tank Meter Code as follows:

   Add the following new table T.2.:

TABLE 2.-TOLERANCES FOR VEHICLE TANK METERS ON SUPPLY EXHAUSTION TESTS EXCEPT MILK METERS	
Manufacturer's rated capacity (Maximum gpm)	**Maintenance and acceptance tolerances**
Up to 125	**125** in^3
126-250	**200** in^3
251-500	**300** in^3
Over 500	**400** in^3

   Amend T.2. to include Table 3 and renumber present Table 2 to Table 3.
   To further clarify this table, the tolerances listed are applied from "0" (zero)—not added to the error found during a normal test.

   Since these requirements are applicable to wholesale devices in the LMD Code, appropriate amendments are recommended to be made to that code.

   (The foregoing item was adopted by voice vote.)

Measurement Canada provided its split-compartment or out-of-product test procedure as follows.

Module 6b: Standard Test Procedures

7. Split-Compartment Or Out-of-Product

Purpose

A split-compartment test verifies the proper operation of air elimination means when the storage tank for the product being measured is pumped dry. This test is only necessary for meters that normally drain a tank completely, such as vehicle-mounted meters and milk-receiving systems.

Procedure

For a multi-compartment tank:

- At the normal operating rate of the meter, start the test from a compartment containing less test liquid than the capacity of the prover.
- Continue the pumping until the lack of liquid supply causes the register to stop or until a maximum of 30 seconds has elapsed.

- Without shutting off the pump, open the valve from a compartment with sufficient liquid to complete the test and then shut the valve from the empty compartment.
- Continue the delivery until the liquid level is in the readable portion of the prover neck.
- Compare the meter registration to the volume actually delivered into the prover. The difference (minus any meter error previously identified at the same rate of flow) is the error in the system under compartment switching conditions.

Rationale 8: Interpretation of Results

Rule 1: The limit of error (LOE) between a fast test and a split test is the absolute value of the limit of error applicable to the meter.

In the case of a meter of a size of 65 mm (2.5 in) or smaller, the absolute value of the limit of error for the split test only is based on a test volume of 900 liters (2.25 liters).

In the case of a meter of a size 75 mm (3 in) or larger, the absolute value of the limit of error for the split test only is based on a test volume of 1500 liters (3.75 liters)

NOTE: These LOEs were agreed to at the Specialists meeting in February 1990.

Example: 2-inch Truck-Mounted Meter		
Prover Size	500 liters	900 liters
Rule 1: LOE	$\pm$ 1.25 liters	$\pm$ 2.25 liters
Maximum difference between the split test and the fast test if the split test error exceeds the 0.25 % LOE	$\pm$ 2.25 liters	$\pm$ 2.25 liters

For a single-compartment tank, this test can only be performed where there is a quick-connect hose coupling upstream of the meter:

- Make a partial delivery from a flooded, primed system.
- During the delivery, close the outlet valve from the tank.
- Break the hose connection, if possible, and let the pump drain the line.
- Continue the test until the lack of liquid supply causes the register to stop or until a maximum of 30 seconds has elapsed.
- Reconnect the sully line, open the valve, and complete the filling of the prover.
- Compare the meter register to the volume actually delivered into the prover. The difference (minus any meter error previously identified at the same rate of flow) is the error in the system under compartment switching conditions.

See interpretation of Results in Rationale 8.

Variation

- Gravity discharge meter.
- The split-compartment test is the same for gravity discharge meters except there is no pump in the system.

At its October 2003 Meeting, the Sector reviewed and discussed the various procedures above. The Sector agreed that the change to Handbook 44 adopted at the 1974 NCWM which recommended that Table 2. – Tolerances For Vehicle-Tank Meters on Supply Exhaustion Tests Except Milk Meters be added to 3.31. Vehicle-Tank Meters code appeared to be technically correct and would be a good solution for addressing the concerns of tolerances that vary based on the size of the test draft. Charlene Numrych (Liquid Controls) stated that the maximum tolerance of 400 in^3 in the 1974 Table is not realistic for some of the larger meter sizes Liquid Controls currently produces. Charlene recommended that additional ranges of 500 gallons to 750 gallons per minute and over 750 gallons per minute be added to the table.

Conclusion: The Sector agreed that an additional flow rate designation should be added to the table and to forward the following amended proposal to modify NIST Handbook 44, Section 3.31 Vehicle-Tank Meters to the NCWM S&T Committee for consideration.

N.4.2. Special Tests (Except Milk-Measuring Systems). "Special" tests shall be made to develop the operating characteristics of a measuring system and any special elements and accessories attached to or associated with the device. Any test except as set forth in N4.4.1. or N.4.5. shall be considered a special test. Special tests of a measuring system shall be made as follows:

(a) at a minimum discharge rate of 20 % of the marked maximum discharge rate or at the minimum discharge rate marked on the device, whichever is less;

(b) to develop operating characteristics of the measuring system ~~during a split compartment delivery.~~

Add new paragraphs N.4.5. Product Depletion Test, T.5. Product Depletion Test, and Table T.5. Tolerances for Vehicle-Tank Meters on Product Depletion Tests Except Milk Meters

N.4.5. Product Depletion Test. - The effectiveness of the vapor eliminator shall be tested by depleting the product supply and continuing until the lack of fluid causes the meter register to stop completely. The test shall be completed by switching to another compartment with sufficient product on a multi-compartment vehicle, or by adding sufficient product to a single-compartment vehicle. When adding product to a single-compartment vehicle, allow appropriate time for any entrapped vapor to disperse before continuing the test.

T.5. Product Depletion Test. - The difference in the delivered volumes for the normal test and the product depletion test shall not exceed the tolerance shown in Table T.5., and all test results shall be within applicable tolerances.

TABLE T.5. TOLERANCES FOR VEHICLE-TANK METERS ON PRODUCT DEPLETION TESTS EXCEPT MILK METERS	
Manufacturer's rated capacity (Maximum gpm)	**Maintenance and acceptance tolerances**
Up to 125	**125** in^3
126 to 250	**200** in^3
25 to 500	**300** in^3
501 to 750	**400** in^3
Over 751	**600** in^3

5. Marking of Meters that have no External Moving Parts - UR.2.5. Product Identification (Carry-Over Item)

Source: Returned from NCWM S&T Committee

Background: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories indicated that field officials in their jurisdiction are sometimes not able to determine which measuring element is associated with a particular grade or blend of fuel on multi-product dispensers. During a field examination of a multi-product dispenser, one grade or blend is rejected for not meeting performance requirements. The official does not know which measuring element to mark or tag as rejected. During the performance of a subsequent inspection following adjustment or repair of the device, the field official may be required to test all grades and blends offered through the rejected dispenser to determine that the correct measuring element and only that element was adjusted. At the 2002 Sector Meeting the Sector developed a proposal that was forwarded to the S&T Committee for consideration.

Recommendation: Modify NIST Handbook 44, Section 3.30. Liquid-Measuring Devices UR.2.5.

UR.2.5. Product ~~Storage~~ Identification

UR.2.5.1. Measuring Element Identification

(a) For multi-product dispensers, any measuring element with no external part(s) that move during delivery shall be plainly and visibly identified as to the grade, blend, or mixture of product being dispensed through the element.

(b) When the measuring elements of any multi-product dispenser are marked by means of a color code, the color key shall be conspicuously displayed at the place of business and be consistent with any color code used for product storage.

UR.2.5.2. Product Storage Identification

(a) The fill connection for any petroleum product storage tank or vessel supplying motor-fuel devices shall be permanently, plainly, and visibly marked as to product contained.

(b) When the fill connection device is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.
(Added 1975 and Amended 1976 and renumbered 200X)

Discussion/Conclusion: Mike Belue (Belue Associates) reported that at its September 2003 Interim Meeting, the Central Weights and Measures Association (CWMA) recommended that the NCWM S&T Committee withdraw this item from its agenda because it places an extra burden on users without benefit to regulators unless there is only one seal that protects multiple measuring elements. The CWMA further believes that this is an enforcement issue in only a few jurisdictions. The Sector voted to recommend that the NCWM S&T Committee withdraw this item from its agenda. The voting results were as follows: in favor of the recommendation to withdraw – 8; opposed to the recommendation to withdraw – 0; abstaining on the issue – 7.

6. Multiple Measuring Elements with a Single Provision for Sealing (Carry-Over Item)

Source: Mike Belue (Belue Associates), NCWM S&T Committee

Background: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories indicated that field officials in their jurisdiction are having difficulty with multi-product dispensers that have only one sealing mechanism for two or more measuring elements. If a field official rejects a meter for not meeting performance requirements, the field official has no way of determining which measuring elements have been recalibrated when returning to re-inspect the dispenser after a service agency has made adjustments or repairs on the rejected device. During the performance of a subsequent inspection following adjustment or repair of the device, the field official may be required to test all grades and blends offered through the rejected dispenser to determine that only the correct measuring element was adjusted.

At its October 2002 meeting, the NTETC Measuring Sector developed the following proposal to address the concern with retail motor-fuel dispensers that have only one sealing mechanism that provides the adjustment security for multiple measuring elements. The Sector agreed to forward the proposal to the S&T Committee for consideration.

At its October 2002 Annual Meeting, the SWMA recommended the proposal to add a new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices paragraph S.2.2.1. be forwarded to the NCWM S&T Committee as an information item.

Recommendation: Add new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing as follows:

S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing. - A change to the adjustment of any measuring element within any multi-product dispenser with a single provision for sealing multiple measuring elements must be identified.

Discussion: At the 2003 NCWM Interim Meeting, the S&T Committee heard support for identifying, in a manner that is readily available to the field official, any measuring element that is adjusted and agreed that the item has merit. Device manufacturers present at the meeting stated that identifying any measuring element that is adjusted is possible on dispensers that have only one sealing mechanism for two or more measuring elements. The manufacturers requested time to develop an appropriate mechanism for providing that information. The Committee gave the item informational status to provide device manufacturers the opportunity to study the issue and develop means for meeting the proposed requirements.

At the 2003 NCWM Annual Meeting, the Committee heard from one of the major RMFD manufacturers that his company is investigating ways to address this problem and provide the necessary calibration information to field officials. The Committee agreed to continue the item's information status to provide the manufacturers additional time to develop a mechanism for making calibration information for each measuring element within a multi-product dispenser with a single provision for sealing available to the field official.

At its October 2003 Meeting, the Sector reviewed its original proposal. Mike Belue (Belue Associates) reported that the CWMA recommended that the NCWM S&T Committee withdraw this item from its agenda as it will place an undue burden on current retailers and not significantly help enforcement officials. Mike further reported that the Western Weights and Measures Association (WWMA) referred the item to the Measuring Sector for further development. The Sector agreed that on a dispenser with a separate sealing mechanism for each measuring element it is normally apparent when a seal is broken. The Sector further agreed that it should be equally apparent when an adjustment is made to any of the measuring elements when only a single mechanism provides security for more than one measuring element.

Conclusion: The Sector modified S.2.2.1. at the meeting and agreed to forward the following recommendation to the NCWM S&T Committee for consideration.:

Add a new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing as follows:

~~S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing. A change to the adjustment of any measuring element~~ within any multi-product dispenser with a single provision for sealing multiple measuring elements must ~~shall be identified.~~

7. Update LMD Section of Publication 14, NTEP Laboratory Recommendations for Changes to NCWM Publication 14 (New Item)

Source: NTEP Laboratories

Background: At the June 2002 NTEP Laboratory Meeting, the laboratories reviewed the Field Evaluation and Permanence Tests for Metering Systems Section "A" through "J" of the 2003 Edition of Publication 14 for Measuring Devices. The labs agreed that the same testing criteria should apply regardless of meter technology. There was consensus that for all meters, except retail motor-fuel dispensers, where possible (if temperature can be varied) a test criteria that is in harmony with the Measurement Canada criteria should be adopted. Where the temperature cannot be varied, all meters except retail motor-fuel dispensers should be tested with 4 drafts at each of 5 flow rates. The labs agreed to submit a recommendation for modifying Publication 14 for consideration at this Measuring Sector Meeting.

Recommendation: Modify NCWM Publication 14 as shown in the following items:

Permanence Test Procedures for Meters

A. Field Evaluation and Permanence Test of New Design Meters in Retail Motor-Fuel Dispensers

All new design meters are subject to a permanence test. If a meter is the same as one in a previously tested dispenser, a permanence test is not required ~~unless a problem has been detected~~. NTEP reserves the right to require a permanence test based on the result of the initial examination.

Initial Examination

1. **All meters of the new type installed at the type evaluation location are subject to examination. At least two meters must be tested.**

2. **At least one meter will be chosen for throughput testing on each of two major products (e.g., unleaded gasoline and diesel fuel). The minimum number of tests for each of these two meters will include the following:**

   - **Five tests at the fast flow rate**
   - **~~Two~~ Three tests at a midrange flow rate**
   - **Five tests at the slow flow rate**

   At least five tests at both the fast and slow flow rates and ~~two~~ three midrange flow rate tests will be run on each of these two meters. Only one test at each flow rate need be run on any remaining meters. If both products are not available for the type evaluation, the test may be performed using one product and a Provisional Certificate of Conformance may be issued for the one product. The test using the other product may be performed at a later date to result in a full Certificate of Conformance.

3. **All meters must perform within acceptance tolerance.**

4. **Repeatability - When consecutive multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance.**

Subsequent Examination

1. **All meters of the new type installed at the type evaluation location must perform within acceptance tolerance throughout the time and volume period specified below.**

2. **The examination will be conducted no sooner than 20 days after the initial examination and not before the previously chosen meters have measured at least 20 000 gallons for throughput testing.**

3. **Five tests at both fast and slow flow rates and ~~two~~ three midrange flow rate tests will be made on the throughput meters. Only one test at each flow rate needs to be performed on any remaining meters.**

4. **Repeatability - When consecutive multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance.**

B. Field Evaluation and Permanence Test of Retail Motor-Fuel Dispensers Using Previously Evaluated Meters

Dispensers using a previously type-evaluated meter will be subject to a permanence test. This will not be an extensive test of the meter, but the meter must remain within acceptance tolerance throughout the permanence test of 20 to 30 days' duration. The meter will receive significant use during this test, but it will not be required to deliver 20 000 gallons. At least one dispenser will be subjected to the permanence test. The accuracy tests are the same as those for new design meters in retail motor-fuel dispensers.

C. Field Evaluation and Permanence Test for Vehicle-Tank Meters, ~~and Wholesale Meters~~ Except for LPG, Cryogenic, and CO^2 Meters

The following tests are considered to be appropriate for vehicle-tank metering systems and except for the vapor or air eliminator test are considered appropriate for wholesale meters:

- **~~Three tests at the maximum discharge rate.~~ Four test drafts at each of five flow rates.**
- **~~Three intermediate flow tests.~~**
- **~~Three slow-flow tests.~~**
- **One vapor or air eliminator (product depletion) test.**

Note: The normal test of a measuring system shall be made at the maximum discharge rate that may be anticipated under the conditions of the installation. Any additional tests conducted at flow rates down to and including one-half the sum of the maximum discharge flow rate and the rated minimum discharge flow rate shall be considered normal tests. (Code Reference N.4.1.)

Only one meter is required for the initial test, and after the test the meter will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters~~:~~ is the ~~M~~maximum rated flow ~~rate~~ in units per minute x 2000. (Canada requires maximum flow rate x 6000.)

Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

Repeatability on Vehicle-Tank Meters (Code Reference T.4.)

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.

~~Split Compartment~~ Product Depletion Test

Before vehicle-mounted applications are listed on an NTEP Certificate of Conformance, the meter must pass a ~~split compartment~~ product deletion test. This policy applies to all meter technologies (e.g., Coriolis mass flow meters, turbine meters, positive displacement meters) even if the meter will never be installed on trucks with more than a single compartment. The permanence test still applies to include the throughput with a duration of a least 20 days. Ideally, this test should be performed with a multiple-compartment vehicle; however, a single-compartment vehicle may be used to simulate the ~~split-compartment~~ product depletion test by running the tank empty; if a multiple-compartment vehicle is unavailable, a single-compartment vehicle may be used to simulate the product depletion test by running the tank empty.

Purpose: A product depletion test verifies the proper operation of air elimination means when the storage tank for the product being measured is pumped dry. This test is necessary for meters that may drain a tank completely, such as a vehicle-tank meter.

Test Procedure: (no change)

D. Wholesale Meters

Tests of Automatic Temperature-Compensating Systems on Wholesale Meters (Code Reference T.2.3.4.)

The difference between the meter error for results determined with and without the automatic temperature-compensating system activated shall not exceed:

1. 0.2 % of the test draft for mechanical automatic temperature-compensating systems; and

2. 0.1 % of the test draft for electronic automatic temperature-compensating systems.

The results of each test shall be within the applicable "acceptance" or maintenance tolerance.

~~E.~~ Repeatability on Wholesale Meters (Code Reference T.2.3.3.)

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance. This tolerance does not apply to the test of the automatic temperature-compensating system.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.

~~F. Repeatability on Vehicle-Tank Meters (Code Reference T.4.)~~

~~When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance.~~

~~Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.~~

~~G.~~ E. Field Evaluation and Permanence Test For LPG and Cryogenic Meters

~~As adopted at the 1985 NCWM, the~~ The following tests are considered to be appropriate for metering systems on LPG and cryogenic meters:

~~1. Three tests at the maximum discharge rate.~~ Four test drafts at each of five flow rates.
~~2. Three intermediate flow tests.~~
~~3. Three slow-flow tests.~~

Only one meter is required for the initial test, after which the meter will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters~~:~~ is the maximum rated flow in units per minute x 2000. (Canada requires maximum flow rate x 6000.)

~~1. Maximum rated flow rate x 1500 for meters rated at 227 Lpm (60 gpm) or greater.~~

~~2. Maximum rated flow rate x 500 for meters rated less than 227 Lpm (60 gpm).~~

~~3. Based upon California weights and measures experience, this corresponds to 30-60 days. The time period is considered appropriate because these meters have a history of becoming inaccurate more frequently than meters for other fuels.~~

Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

~~H.~~ Repeatability on LPG & NH3 Meters (Code Reference T.3.)

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within acceptance tolerance. This tolerance does not apply to the test of the automatic temperature-compensating system.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.

Note: Stable temperature and pressure indications are necessary during the entire repeatability test to achieve good test results. For multiple drafts to determine repeatability, the following conditions shall be maintained;

1. **The range of flow rates shall not exceed 5 % of the first test draft.**
2. **The range of temperatures at the meter shall not exceed 1 °C (2 °F).**
3. **The range of pressure shall not exceed 68.95 Kpa, or 10 PSI.**
4. **The temperature difference between the meter and the prover shall not exceed 1 °C (2 °F).**

If these conditions cannot be met, repeatability tolerances shall not be applied. Repeatability tests must include at least three consecutive test drafts.

~~I.~~ Tests of Automatic Temperature-Compensating Systems - LPG & NH3 Meters

The difference between the meter error for results determined with and without the automatic temperature-compensating system activated shall not exceed:

1. **0.5 % of the test draft for mechanical automatic temperature-compensating systems; and**

2. **0.25 % of the test draft for electronic automatic temperature-compensating systems.**

The results of each test shall be within the applicable "acceptance" or maintenance tolerance.

~~J.~~ F. Field Evaluation and Permanence Test for LPG Vapor Meters

The following tests are to be run on an LPG vapor meter as part of the permanence test:

1. **Three tests at the maximum discharge rate.**
2. **Three slow-flow tests.**
3. **One low-flame test.**

Only one meter will be required for the initial test, after which the meter must have air or product passed through it as part of the permanence test. The amount of air or product shall be at least the maximum flow rate times 1000. California Weights and Measures performs this test in approximately 60 days. Although it is longer than the usual 30-day test, this is considered appropriate because these meters are usually tested only every ten years.

Following the period of accelerated use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

~~K.~~ G. Repeatability on Milk Meters (Code References N.4.1.1. and T.3.)

When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.

~~L.~~ H. Field Evaluation and Permanence Test For Turbine Meters

The following tests are considered to be appropriate for turbine meters:

1. **Meters tested in a laboratory environment will be tested five times at each of four different flow rates, using varsol or water for both the initial and the follow-up evaluation to establish "baseline" data for the meter's performance. A Certificate of Conformance may be issued for the product(s) tested in the laboratory; however, additional products will not be included until testing is completed with these products. After a "baseline" is obtained, products can be included on the Certificate of Conformance by performing three tests at each of four different flow rates in the field for both the initial and follow-up evaluation. If a meter is tested in the field without first determining a "baseline," the meter must undergo ~~five~~ four tests at each of ~~four~~ five different flow rates; this criteria applies for both the initial and follow-up test."**

2. **At least one meter is required for each product type for the initial test.**

3. **If the meter is to be used with products other than gasoline and diesel fuel, the manufacturer must also submit data to indicate meter performance over the range of viscosity of products to be used with the meter.**

4. **To indicate meter performance over the temperature range in which the meter is anticipated to be used, data must also be submitted.**

5. **Following the initial test, the meters will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters is the maximum rated flow ~~rate~~ in units per minute x 2000. (Canada requires maximum flow rate x 6000.)**

6. **Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances. Following evaluation of test data and analysis of the data presented by the manufacturer for meter performance over temperature and viscosity ranges, the evaluating laboratory may require additional testing prior to issuing a Certificate of Conformance for the meter.**

~~M.~~ I. Permanence Tests for Mass Flow Meters

The following tests are considered to be appropriate for mass flow meters:

Type evaluation. **The gravimetric test method shall be used for type evaluation for meters indicating only in units of mass and may be used for meters indicating in units of volume. Meters indicating in only units of volume may be tested using a volumetric standard.**

Gravimetric Standard. (no change)

Test Drafts. (no change)

Test Data. Meters tested in a laboratory environment will be tested ~~five~~ four times at each of ~~four~~five different flow rates. Use the product available in the laboratory for both the initial and the follow-up evaluation to establish "baseline" data for the meter's performance. A Certificate of Conformance may be issued for the product(s) tested in the laboratory; however, additional products will not be included on the Certificate until testing is completed with those products. After a "baseline" is obtained, products can be included on the Certificate of Conformance by performing three tests at each of four different flow rates in the field for both the initial and follow-up evaluation. If a meter is tested in the field without first determining a "baseline," the meter must undergo ~~five~~ four tests at each of ~~four~~ five different flow rates; this criteria applies for both the initial and follow-up test.

Following the initial test, the meters will be placed into service for the permanence test. The minimum throughput criterion recommended for these meters ~~are 60 days, or~~ is 2000 x the maximum rated flow ~~rate~~ in units per minute ~~achieved in the installation, whichever comes first~~. Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

Testing for Volume Units Only or to Add Volume Units to Existing Certificates.

In order to add volumetric indications to an existing NTEP Certificate of Conformance (CC) for a meter that already covers mass indications, the following criteria relative to meter sizes to be covered on the CC must be met:

- **At least one meter size must be tested in the volumetric mode.**
- **If the meter size(s) selected for testing is not already covered on the existing CC, then the request is treated as a submission to add a new meter size (i.e., a permanence test is required and testing must be performed in both the mass and the volume modes of operation).**

Note: During an evaluation of a meter to add volume unit to an existing certificate, the ~~The~~ tolerance specified in the mass flow meters code is to be applied to both the initial and the final tests. No adjustments may be made to the meter during this period. This tolerance is to be applied even if different liquid temperatures and pressures exist between the initial and final tests. During the evaluation of a meter for volume units only for a product- specific application where a separate product-specific Handbook 44 code exists (i.e., LPG, cryogenic liquids, CO^2, etc.), the appropriate Handbook 44 section for the intended application will be applied.

Determination of performance relative to repeatability, accuracy, and linearity should be performed using accepted statistical methodology. Reference documents include: 1) SAMA Standard PMC 20.1-1973, Process Measurement and Control Terminology; 2) ANSI/ASME MFC-2M-1983, Measurement Uncertainty for Fluid Flow in Closed Conduits; and 3) ANSI/ASME MFC-1M-1979, Glossary of Terms Used in the Measurement of Fluid Flow in Pipes.

Repeatability for Mass Flow Meters (Mass Flow Meters Code Reference T.3.). (no change)

Additional Considerations for Testing Mass Flow Meters Dispensing Compressed Natural Gas (CNG). (no change)

~~N.~~ J. Testing of Lubricating Oil Meters. (no change)

Discussion/Conclusion: Only one manufacturer of mass flow meters was represented at the October 2003 NTETC Measuring Sector Meeting. The Sector agreed the proposed change to the time and use requirements in Section I Permanence Test for Mass Flow Meters in Publication 14 should not be changed without input from other manufacturers of mass flow meters. The Sector agreed with the balance of the recommended Publication 14 changes proposed by the NTEP laboratories. A member noted that the tolerances For Tests of Automatic Temperature-Compensating Systems – LPG and NH3 Meters were incorrect. The tolerances in Handbook 44 3.32 LPG and Anhydrous Ammonia Liquid-Measuring Devices T.4. were changed in 1997; however, Publication 14 was never updated to reflect the change. The

Sector agreed to submit the following recommendation to modify Publication 14 to the NTEP Committee for consideration:

A. Field Evaluation and Permanence Test of New-Design Meters in Retail Motor Fuel Dispensers

All new design meters are subject to a permanence test. If a meter is the same as one in a previously tested dispenser, a permanence test is not required ~~unless a problem has been detected~~. NTEP reserves the right to require a permanence test based on the result of the initial examination.

Initial Examination

1. **All meters of the new type installed at the type evaluation location are subject to examination. At least two meters must be tested.**

2. **At least one meter will be chosen for throughput testing on each of two major products (e.g., unleaded gasoline and diesel fuel). The minimum number of tests for each of these two meters will include the following:**

   - **Five tests at the fast flow rate**
   - **~~Two~~ Three tests at a midrange flow rate**
   - **Five tests at the slow flow rate**

   At least five tests at both the fast and slow flow rates and ~~two~~ three midrange flow rate tests will be run on each of these two meters. Only one test at each flow rate need be run on any remaining meters. If both products are not available for the type evaluation, the test may be performed using one product and a Provisional Certificate of Conformance may be issued for the one product. The test using the other product may be performed at a later date to result in a full Certificate of Conformance.

3. **All meters must perform within acceptance tolerance.**

4. **Repeatability - When consecutive multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance.**

Subsequent Examination

1. **All meters of the new type installed at the type evaluation location must perform within acceptance tolerance throughout the time and volume period specified below.**

2. **The examination will be conducted no sooner than 20 days after the initial examination and not before the previously chosen meters have measured at least 20 000 gallons for throughput testing.**

3. **Five tests at both fast and slow flow rates, and ~~two~~ three midrange flow rate tests will be made on the throughput meters. Only one test at each flow rate needs to be performed on any remaining meters.**

4. **Repeatability - When consecutive multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance.**

B. Field Evaluation ~~and Permanence~~ Test of Previously Evaluated Retail Motor-Fuel Dispensers Using Different Previously Evaluated Meters

Previously evaluated d~~D~~ispensers using a previously type-evaluated meter and indicator will be subject to an initial ~~permanence~~ test. ~~This will not be an extensive test of the meter, but the meter~~

~~must remain within acceptance tolerance throughout the permanence test of 20-30 day duration. The meter will receive significant use during this test, but it will not be required to deliver 20 000 gallons. At least one dispenser will be subjected to the permanence test. The accuracy tests are the same as those for new design meters in retail motor fuel dispensers.~~ **Based on the test results of the initial test, NTEP may require a permanence test.**

C. Field Evaluation and Permanence Test for Vehicle-Tank Meters, ~~and Wholesale Meters~~ Except for LPG, Cryogenic, and CO_2 Meters

The following tests are considered to be appropriate for vehicle-tank metering systems ~~and except for the vapor or air eliminator tests, are considered appropriate for wholesale meters~~:

- ~~Three tests at the maximum discharge rate.~~ **Four test drafts at each of five flow rates.**
- ~~Three intermediate flow tests.~~
- ~~Three slow-flow tests.~~
- **One vapor or air eliminator (product depletion) test.**

Note: The normal test of a measuring system shall be made at the maximum discharge rate that may be anticipated under the conditions of the installation. Any additional tests conducted at flow rates down to and including one-half the sum of the maximum discharge flow rate and the rated minimum discharge flow rate shall be considered normal tests. (Code reference N.4.1.)

Only one meter is required for the initial test, and after the test the meter will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters~~:~~ is the ~~M~~maximum rated flow ~~rate~~ in units per minute x 2000. (Canada requires maximum flow rate x 6000.)

Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

Repeatability on Vehicle-Tank Meters *(Code Reference T.4.)*

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.

~~Split Compartment~~ **Product Depletion Test**

Before vehicle-mounted applications are listed on an NTEP Certificate of Conformance, the meter must pass a ~~split compartment~~ product deletion test. This policy applies to all meter technologies (e.g., Coriolis mass flow meters, turbine meters, positive displacement meters) even if the meter will never be installed on trucks with more than a single compartment. The permanence test still applies to include the throughput and with a duration of a least 20 days. Ideally, this test should be performed with a multiple-compartment vehicle; however, if a multiple-compartment vehicle is unavailable, a single-compartment vehicle may be used to simulate the ~~split compartment~~ product depletion test by running the tank empty.

Purpose: A product depletion test verifies the proper operation of air elimination means when the storage tank for the product being measured is pumped dry. This test is necessary for meters that may drain a tank completely, such as a vehicle-tank meter.

Test Procedure: (no change)

D. Field Evaluation and Permanence Test for Wholesale Meters

Tests of Automatic Temperature-Compensating Systems on Wholesale Meters (Code Reference T.2.3.4.)

The difference between the meter error for results determined with and without the automatic temperature-compensating system activated shall not exceed:

1. **0.2 % of the test draft for mechanical automatic temperature-compensating systems; and**

2. **0.1 % of the test draft for electronic automatic temperature-compensating systems.**

The results of each test shall be within the applicable "acceptance" or maintenance tolerance.

~~**E.**~~ **Repeatability on Wholesale Meters (Code Reference T.2.3.3.)**

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance. This tolerance does not apply to the test of the automatic temperature-compensating system.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.

~~**F. Repeatability on Vehicle-Tank Meters (Code Reference T.4.)**~~

~~**When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance.**~~

~~**Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.**~~

~~**G.**~~ **E. Field Evaluation and Permanence Test for LPG and Cryogenic Meters**

~~**As adopted at the 1985 NCWM, the**~~ **The following tests are considered to be appropriate for metering systems on LPG and cryogenic meters:**

~~**1. Three tests at the maximum discharge rate.**~~ **Four test drafts at each of five flow rates.**
~~**2. Three intermediate flow tests.**~~
~~**3. Three slow-flow tests.**~~

Only one meter is required for the initial test, after which the meter will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters~~:~~ is the maximum rated flow in units per minute x 2000. (Canada requires maximum flow rate x 6000.)

~~**1. Maximum rated flow rate x 1500 for meters rated at 227 Lpm (60 gpm) or greater.**~~

~~**2. Maximum rated flow rate x 500 for meters rated less than 227 Lpm (60 gpm).**~~

~~3. Based upon California weights and measures experience, this corresponds to 30-60 days. The time period is considered appropriate because these meters have a history of becoming inaccurate more frequently than meters for other fuels.~~

Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

~~H.~~ Repeatability on LPG & NH3 Meters (Code Reference T.3.)

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within acceptance tolerance. This tolerance does not apply to the test of the automatic temperature-compensating system.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.

Note: Stable temperature and pressure indications are necessary during the entire repeatability test to achieve good test results. For multiple drafts to determine repeatability, the following conditions shall be maintained;

1. **The range of flow rates shall not exceed 5 % of the first test draft.**
2. **The range of temperatures at the meter shall not exceed 1 °C (2 °F).**
3. **The range of pressure shall not exceed 68.95 Kpa, or 10 PSI.**
4. **The temperature difference between the meter and the prover shall not exceed 1 °C (2 °F)**

If these conditions cannot be met, repeatability tolerances shall not be applied. Repeatability tests must include at least three consecutive test drafts.

~~I.~~ Tests of Automatic Temperature-Compensating Systems - LPG & NH3 Meters

The difference between the meter error for results determined with and without the automatic temperature-compensating system activated shall not exceed:

1. **~~0.5~~ 1.0 % of the test draft for mechanical automatic temperature-compensating systems; and**

2. **~~0.25~~ 0.5 % of the test draft for electronic automatic temperature- compensating systems.**

The results of each test shall be within the applicable "acceptance" or maintenance tolerance.

~~J.~~ F. Field Evaluation and Permanence Test for LPG Vapor Meters

The following tests are to be run on an LPG vapor meter as part of the permanence test:

1. **Three tests at the maximum discharge rate.**
2. **Three slow-flow tests.**
3. **One low-flame test.**

Only one meter will be required for the initial test, after which the meter must have air or product passed through it as part of the permanence test. The amount of air or product shall be at least the maximum flow rate times 1000. California Weights and Measures performs this test in approximately 60 days. Although it is longer than the usual 30-day test, this is considered appropriate because these meters are usually tested only every ten years.

Following the period of accelerated use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

~~K.~~ G. Repeatability on Milk Meters (Code Reference N.4.1.1. and T.3.)

When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.

~~L.~~ H. Field Evaluation and Permanence Test for Turbine Meters

The following tests are considered to be appropriate for turbine meters:

1. **Meters tested in a laboratory environment will be tested five times at each of four different flow rates, using varsol or water for both the initial and the follow-up evaluation to establish "baseline" data for the meter's performance. A Certificate of Conformance may be issued for the product(s) tested in the laboratory; however, additional products will not be included until testing is completed with these products. After a "baseline" is obtained, products can be included on the Certificate of Conformance by performing three tests at each of four different flow rates in the field for both the initial and follow-up evaluation. If a meter is tested in the field without first determining a "baseline," the meter must undergo ~~five~~ four tests at each of ~~four~~ five different flow rates; this criteria applies for both the initial and follow-up test."**

2. **At least one meter is required for each product type for the initial test.**

3. **If the meter is to be used with products other than gasoline and diesel fuel, the manufacturer must also submit data to indicate meter performance over the range of viscosity of products to be used with the meter.**

4. **To indicate meter performance over the temperature range in which the meter is anticipated to be used, data must also be submitted.**

5. **Following the initial test, the meters will be placed into service for the permanence test. The ~~following~~ minimum throughput criterion ~~is recommended~~ for these meters is the maximum rated flow ~~rate~~ in units per minute x 2000. (Canada requires maximum flow rate x 6000.)**

6. **Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances. Following evaluation of test data and analysis of the data presented by the manufacturer for meter performance over temperature and viscosity ranges, the evaluating laboratory may require additional testing prior to issuing a Certificate of Conformance for the meter.**

~~M.~~ I. Permanence Tests for Mass Flow Meters

The following tests are considered to be appropriate for mass flow meters:

Type evaluation. The gravimetric test method shall be used for type evaluation for meters indicating only in units of mass and may be used for meters indicating in units of volume. Meters indicating in only units of volume may be tested using a volumetric standard.

Gravimetric Standard. (no change)

Test Drafts. (no change)

Test Data. Meters tested in a laboratory environment will be tested ~~five~~ four times at each of ~~four~~ five different flow rates. Use the product available in the laboratory for both the initial and the follow-up evaluation to establish "baseline" data for the meter's performance. A Certificate of Conformance may be issued for the product(s) tested in the laboratory; however, additional products will not be included on the Certificate until testing is completed with these products. After a "baseline" is obtained, products can be included on the Certificate of Conformance by performing three tests at each of four different flow rates in the field for both the initial and follow-up evaluation. If a meter is tested in the field without first determining a "baseline," the meter must undergo ~~five~~ four tests at each of ~~four~~ five different flow rates; this criteria applies for both the initial and follow-up test.

Following the initial test, the meters will be placed into service for the permanence test. The minimum throughput criterion recommended for these meters is 60 days, or 2000 x the maximum rated flow ~~rate~~ in units per minute ~~achieved in the installation, whichever comes first~~. Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.

Testing for Volume Units Only or to Add Volume Units to Existing Certificates.

In order to add volumetric indications to an existing NTEP Certificate of Conformance (CC) for a meter that already covers mass indications, the following criteria relative to meter sizes to be covered on the CC must be met:

- **At least one meter size must be tested in the volumetric mode.**
- **If the meter size(s) selected for testing is not already covered on the existing CC, then the request is treated as a submission to add a new meter size (i.e., a permanence test is required and testing must be performed in both the mass and the volume modes of operation).**

Note: During an evaluation of a meter to add volume units to an existing certificate, the ~~The~~ tolerance specified in the mass flow meters code is to be applied to both the initial and the final tests. No adjustments may be made to the meter during this period. This tolerance is to be applied even if different liquid temperatures and pressures exist between the initial and final tests. During the evaluation of a meter for volume units only for a product-specific application where a separate product-specific Handbook 44 code exists (i.e., LPG, cryogenic liquids, CO_2, etc.), the appropriate Handbook 44 section for the intended application will be applied.

Determination of performance relative to repeatability, accuracy, and linearity should be performed using accepted statistical methodology. Reference documents include: 1) SAMA Standard PMC 20.1-1973, Process Measurement and Control Terminology; 2) ANSI/ASME MFC-2M-1983, Measurement Uncertainty for Fluid Flow in Closed Conduits; and 3) ANSI/ASME MFC-1M-1979, Glossary of Terms Used in the Measurement of Fluid Flow in Pipes.

Repeatability for Mass Flow Meters (Mass Flow Meters Code Reference T.3.) (no change)

Additional Considerations for Testing Mass Flow Meters Dispensing Compressed Natural Gas (CNG). (no change)

~~N.~~ J. Testing of Lubricating Oil Meters. (no change)

8. Uniform Tolerances for the Same Accuracy Class Device in all LMD Codes (New Item)

Source: NIST/WMD

Background: Currently NIST Handbook 44 Liquid Measuring Devices (LMD), Vehicle Tank-Meters (VTM), and Mass Flow Meters (MFM) Codes include different tolerances for 0.3 Accuracy Class meters. This creates a technical inconsistency among the codes. Tighter tolerances are applied to vehicle-mounted positive displacement (PD) meters than stationary PD meters even though the same model of meter may be used in both applications. There is no technical justification for this difference. A similar inconsistency in tolerances is found between the MFM and VTM Codes. The Mass Flow Meters Code was developed with the understanding that all liquid-measuring devices used in similar applications would be held to similar tolerances. The proposed changes will result in the application of slightly tighter tolerances to LMDs and MFMs than are in the current codes.

PROPOSAL: Align the acceptance tolerance and special test tolerance in the Liquid Measuring Devices and Mass Flow Meters Codes for 0.3 Accuracy Class meter with corresponding tolerances in the Vehicle-Tank Meters Code.

Modify Liquid Measuring Devices Code Table T.2. Accuracy Classes for Liquid Measuring Devices Covered in NIST Handbook 44 Section 3.30 as follows:

Table T.2. Accuracy Classes for Liquid-Measuring Devices Covered in NIST Handbook 44 Section 3.30

Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance
0.3	**Petroleum products including large capacity motor-fuel devices (flow rates over 115 L/min (30 gpm))**, heated products at or greater than 50 °C asphalt at or below temperatures 50 °C, all other liquids not shown where the typical delivery is over 200 L (50 gal)**	**0.~~2~~15 %**	**0.3 %**	**0.45 %**
0.3A	**Asphalt at temperatures greater than 50 °C**	**0.3 %**	**0.3 %**	**0.5 %**
0.5*	**Petroleum products delivered from small capacity (at 4 L/min (1 gpm) through 115 L/min (30 gpm))** motor-fuel devices, agri-chemical liquids, and all other applications not shown.**	**0.3 %**	**0.5 %**	**0.5 %**
1.1	**Petroleum products and other normal liquids from devices with flow rates** less than 1 gpm and devices designed to deliver less than one gallon.**	**0.75 %**	**1.0 %**	**1.25 %**

***The maintenance tolerances on normal and special tests for 5-gallon and 10-gallon test drafts are 6 cubic inches and 11 cubic inches, respectively. Acceptance tolerances on normal and special tests are 3 cubic inches and 5.5 cubic inches.**

**** Flow rate refers to designed or marked maximum flow rate.**

Modify Mass Flow Meters Code Table T.2. Accuracy Classes for Mass Flow Meter Applications as follows:

Table T.2. Accuracy Classes for Mass Flow Meter Applications				
Accuracy Class	**Application or Commodity Being Measured**	**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Tolerance**
0.3	**Loading-rack meters, vehicle-tank meters, home heating oil, heated products (except asphalt above 50 EC), asphalt 50 EC or below, milk and other food products, large capacity motor-fuel dispensers (maximum discharge flow rates greater than 100 L or 25 gallon per minute), all other liquid applications not shown in the table where the minimum delivery is at least 700 kg (1500 lb)**	**0.~~2~~15 %**	**0.3 %**	**0.~~4~~5 %**
0.3A	**Asphalt above 50 EC**	**0.3 %**	**0.3 %**	**0.5 %**
0.5	**Small capacity (retail) motor-fuel dispensers, agri-chemical liquids, all other liquid applications not shown in the table**	**0.3 %**	**0.5 %**	**0.5 %**
1.0	**Anhydrous ammonia, LP Gas (including vehicle tank meters)**	**0.6 %**	**1.0 %**	**1.0 %**
2.0	**Compressed natural gas as a motor fuel**	**1.5 %**	**2.0 %**	**2.0 %**
2.5	**Cryogenic liquid meters, liquefied compressed gases other than LP Gas**	**1.5 %**	**2.5 %**	**2.5 %**

Discussion/Conclusion: The Sector agreed with the manufacturers of turbine meters and mass flow meters represented at the meeting that decreasing the tolerances for those meter types was inappropriate because it would be very difficult, if not impossible for those meter types to comply. Uniformity across the codes is not sufficient justification for changing the tolerances. The Sector voted to oppose the proposed changes to the tolerances in the Liquid-Measuring Devices and the Mass Flow Meters Codes as follows: members opposed to the change – 9; members in support of the change – 0. WMD abstained and will recommend that the tolerances in Handbook 44 Section 3.31. Vehicle-Tank Meters be changed to be consistent with the tolerances in Section 3.30. Liquid-Measuring Devices.

9. S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers (New Item)

Source: NIST/WMD

Background: The current language in paragraph S.4.4.2.(c) as written can be interpreted to allow the placement of G-S.1. Identification markings on a door or panel that is removable. Additionally, this wording might be interpreted to allow placement of marking information on a panel that can be easily removed through the use of a key (e.g., lower meter access panels). This interpretation would be in conflict with paragraph S.4.4.2.(a). The proposed modifications to paragraph S.4.4.2.(c) clarifies the original intent, where it is acceptable to place G-S.1. information on permanent components located 24 inches to 60 inches above the base of the dispenser within the dispenser cabinet. However, in some cases those components can only be accessed by opening a door or panel that requires the use of a key or other tool separate from the device. For comparison, Paragraph S.6.2. Location of Marking Information, in the Scales Code, includes similar language that provides acceptable means for accessing the required marking information.

Recommendation: Modify Liquid-Measuring Devices Code paragraph S.4.4.2 Location of Marking Information; Retail Motor-Fuel Dispensers as follows:

S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers. - The required marking information in the General Code, Paragraph G-S.1. shall appear as follows:

Placement of this information shall not be on a portion of the device that can be readily removed or interchanged without the use of a tool separate from the device.

The information shall appear 24 inches to 60 inches from the base of the dispenser when placed on the outside of the device.

~~When~~ This information may be placed behind a~~n accecss~~ door or panel which may require the use of a key or other tool separate from the device for access. In this case the information shall appear 24 inches to 60 inches from the base of the dispenser in a readily legible position. ~~The use of a dispenser key shall not be considered a tool separate from the device.~~
[Nonretroactive as of January 1, 2003]

Discussion/Conclusion: The Sector generally supported the proposal to modify S.4.4.2. Gordon Johnson (Gilbarco) recommended that the upper height limit be raised to 72 inches. Gilbarco manufactures dispensers that have the general form of an "H." Gilbarco, in the past placed the identification information on the inner surface of an upper panel immediately above the main dispenser cabinet. That location is slightly higher than 60 inches. In 2002 when the NCWM adopted the current language in S.4.4.2., it forced Gilbarco to move the required identification information to a location inside the dispenser. Mike Belue (Bleue Associates) reported that the WWMA reviewed the above proposal and recommended it be made a developing item on the NCWM S&T Committee agenda. The CWMA recommended that the item be withdrawn from the NCWM S&T Committee agenda.

During its 2003 Meeting, the Sector developed a new proposal to amend Handbook 44 Paragraph S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers and agreed to forward the proposal to the NCWM S&T Committee for consideration as follows:

S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers. – The required marking information in the General Code, Paragraph G-S.1. shall appear as follows:

~~**Placement of this information shall not be on a portion of the device that can be readily removed or interchanged without the use of a tool separate from the device.**~~

~~**The information shall appear 24 inches to 60 inches from the base of the dispenser when placed on the outside of the device.**~~

~~**When placed behind an access door or panel the information shall appear 24 inches to 60 inches from the base of the dispenser in a readily legible position. The use of a dispenser key shall not be considered a tool separate from the device.**~~

Placement of the marking information:

(a) shall be within 24 to 72 inches of the base of the dispenser;
(b) may be internal and/or external
(c) may require a key or tool for access; and
(d) shall be on a portion of the device that cannot be readily removed or interchanged.

[Nonretroactive as of January 1, 200~~3~~X]

10. Product Family Tables for MAG Meters (Carry-Over Item)

Source: Liquid Controls LLC

Background: At present no product family criteria exist for Mag Meters. If a manufacturer wants a CC which covers multiple products, testing must be conducted on each product. Liquid Controls is asking the Sector to consider the adoption of a product family of liquids criteria for MAG Meters and will provide a specific proposal for Sector consideration at the September 2002 Meeting.

At the 2002 Sector Meeting a work group was formed to address this issue. The Sector will consider the recommendations of that work group.

Discussion: Prior to the 2003 Sector Meeting the technical advisor was informed that this work group is not ready to present a recommendation. The work group requests that the item remain on the agenda for further development.

Conclusion: The Sector agreed that a new work group should be formed to develop family product tables, for Mag Meters, Ultrasonic Meters, and Turbine Meters for consideration by the Sector at its next meeting. The members of the new work group are: Charlene Numrych (Liquid Controls) Chair, Richard Miller (FMC), Joe Buxton (Daniel Measurement & Control), Randy Byrtus (Measurement Canada). Charlene volunteered to contact other manufacturers to invite them to participate in the work group.

11. Use of Discount and Loyalty Cards and Discounts for Actions After the Completion of a Retail Motor-Fuel Delivery (Carry-Over Item)

Source: NTEP Laboratories

Background: At the June 2002 NTEP Laboratory Meeting, the laboratories agreed there is a need for guidance to determine whether or not a specific discount program or application is appropriate and meets NTEP requirements.

Examples include: The change to a discount prices when a club card is inserted and the automatic return to the nonmember price at the completion of the delivery; a change in the posted price to include a discount for the purchase of a car wash or other item when a credit card is used at the pump but is not available at the pump in a post pay situation; a discount to the unit price for the purchases of certain items after the delivery has been completed.

Recommendation:

The laboratories did not have a specific recommendation at this time but asked the Sector to organize a work group to identify the issues and develop consistent guidelines and requirements for the use of various discount programs.

At the 2002 Sector Meeting a work group was formed to address this issue. The Sector agreed to consider the recommendations of that work group at the 2003 Sector Meeting.

Discussion/Conclusion: No input has been received from the work group assigned to develop this issue. The Sector agreed that the work requested by the NTEP laboratories pertaining to this issue is outside of scope of the Sector. The Sector also agreed to forward a recommendation through the NTEP Committee that the NCWM form a work group to consider the issues and develop appropriate recommendations regarding legal and equitable trade practices for consideration by all NCWM members.

12. Test Criteria for CNG Dispensers in Publication 14 (New Item)

Source: NIST/WMD

Background: Publication 14 currently contains a note that states test procedures are being developed and a draft of the procedures is available from NIST/WMD. The test procedures were finalized and published in NIST Handbook 112, EPO 28 in 2002.

Recommendation: The Sector reviewed the recommendation that the NTEP Committee add the following test criteria from EPO 28 Compressed Natural Gas Retail Motor-Fuel Dispensers to Publication 14 Additional Considerations for Testing Mass Flow Meters Dispensing Compressed Natural Gas (CNG) beginning on page LMD-77 of the 2003 edition.

Additional Considerations for Testing Mass Flow Meters Dispensing Compressed Natural Gas (CNG):

~~Note: The NCWM is currently work with the Natural Gas Vehicle Coalition to develop field test procedures for CNG dispensers. Copies of draft procedures submitted to date are available from the NIST Office of Weights and Measures.~~

1. Ideally, the device should be tested over a temperature range. Because this is not possible to easily regulate in the field to observe any effects of temperature changes test early in the day and then again later in the day.

Note: The evaluating laboratory should attempt to test at as wide a temperature range as possible; however, it is recognized that this may not always be possible and, in some cases, little or no variation in temperature will be experienced.

2. The magnitude of the draft (and, therefore, the time required for delivery) may impact upon the test results. For very small drafts, the start and stop effects can become significant and may result in large variability. Because CNG stations are presently few and far between in some areas, it is anticipated that these devices will be heavily used to "top off" tanks. Consequently, the minimum measured quantity declared for the device can be significant. It is desirable to have at least some tests run at or near the minimum measured quantity.

3. In setting up the arrangements for testing, the resolution of the scale relative to the test draft must be considered, and "rounding error" of the scale must be kept to an acceptably small level. As a general guideline, the value of the scale division should not exceed one-tenth of the tolerance applied to the device. A high-resolution scale is needed; error weights should be used; or a larger test draft selected. A combination of these approaches may be used. The total error of the transfer standard must be limited to less than one-third of the tolerance. Therefore, the scale must be thoroughly tested, the repeatability of the scale verified, and corrections made to the results of the meter test to correct for any errors determined during the scale test.

4. The repeatability of the test results must be within 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerances.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.

5. Repeat tests should be run over a range of flows or, because the device may operate at only one flow in the field installation, over a range of quantities.

6. The typical tank size being filled by the device will be 7 kg to 10 kg (16 lb to 20 lb). A very large tank size may be 20 kg (40 lb) if a vehicle is equipped with two tanks. The average amount dispensed will probably be around 4 kg (8 lb).

7. Because the zero changes with temperature, the zero must be sealable as noted in the Mass Flow Meters Code in H44. CNG meters must indicate on the basis of mass, with the computation of total sale based on mass units. Supplemental units may be used in addition to the mass units, but these must be clearly identified as supplementary units. It is suggested that conversion charts be provided to explain to the consumer how the conversion factor for the supplemental units is derived.

The following tests are considered appropriate for CNG Dispensers:

1. Normal test ..... S.3.7.,N.4., N.6.1, T.2., T.3.
   Computer jump:
   Remove nozzle from dispenser and connect to test cylinder. (Test cylinder pressure should not be greater than 200 psi to simulate an actual delivery.)
   Turn nozzle valve from “OFF” position to “FILL” position.
   Empty discharge hose.
   Turn nozzle valve to “OFF” position.
   Activate dispenser.
   Observe dispenser indications, if computer jump occurs take appropriate action.

NOTE: A test cylinder is not necessary for the computer jump test on dispensers equipped with an autovent system. To test, turn dispenser on and observe the indication display for computer jump when the dispenser shuts off.

Minimum test drafts are as follows:
Place empty test cylinder on the scale.
Access mass display of the dispenser.
Tare the weight of the test cylinder, chocks, and stand.
Connect the nozzle to the test cylinder.
Fill the test cylinder to 1/3 capacity full at maximum flow rate.

Disconnect the nozzle from the test cylinder.
Compare mass display to scale indication.
Determine dispenser error..... T.2.
Leave product in test cylinder.
Tare the weight of the test cylinder, chocks and stand.
Connect the nozzle to the test cylinder.
Begin the fill operation with product in the cylinder; fill cylinder to 2/3 capacity at maximum flow rate.

Disconnect the nozzle from the test cylinder.
Compare mass display to scale indication.
Determine dispenser error..... T.2.
Tare the weight of the test cylinder, chocks, and stand.
Connect the nozzle to the test cylinder.
Begin the fill operation with product in the cylinder; fill cylinder to capacity at maximum flow rate.

Disconnect the nozzle from the test cylinder.
Compare mass display to scale indication.
Determine dispenser error..... T.2.
Return product to owner/operator of dispenser ..... UR.3.8.
Place empty test cylinder on scale (scale may be supported by chocks and stand.)
Tare the weight of the test cylinder, chocks, and stand.
Connect the nozzle to the test cylinder.
Fill test cylinder to capacity at maximum flow rate.

Disconnect the nozzle from the test cylinder.
Compare mass display to scale indication.
Determine dispenser error..... T.2.
Return product to owner/operator of dispenser.
Repeating previous tests ..... T.3.(a)
Applicable tolerance for multiple tests at the same flow rate
Return product to owner/operator of dispenser.
If the meter's minimum measured quantity (MMQ) is less than the smallest test draft, conduct a test at the MMQ value..... N.4.

NOTE: If 300 divisions (d) or 2.27 kilograms (5 pounds) is greater than 1/3 of the test cylinder capacity, then the test cylinder should be emptied to accommodate a delivery of at least 300 d or 2.27 kilograms (5 pounds); otherwise a larger tank is necessary.

2. Check effectiveness of zero-setback interlock..... S.3.8., UR3.6., UR.3.7.
No subsequent delivery made until indicating and recording element returned to zero.
After delivery is complete, the dispenser starting lever (mechanism) is shutoff, interlock engaged, and discharge nozzle is placed in the designed hanging position. (Note: This does not apply to nozzle control.)

Remove nozzle from hanging position.

Reset computer to zero and turn on dispenser.

Attempt to return the nozzle to its designed hanging position, carefully remove nozzle and connect it to the test tank and open valve. Move the dispenser starting lever (mechanism) to "ON" position and attempt to dispense product. (Note: This does not apply to nozzle control.)

Product should not flow without resetting the indications to zero.

3. Check operation of low-flow cut-off valve..... UR.2.3.
   Valve shall not be set lower than the minimum flow rate.
   Valve stops registration when flow is below the low-flow cut-off value.

   Connect nozzle to empty test tank and dispense product. Slowly throttle down on the valve on the test tank to the minimum attainable flow rate. Product delivery should not occur below the mass flow meter minimum flow rate.

4. Power loss test ..... S.2.4.1., S.2.4.2.
   If transaction is in progress at power loss, information shall be retainable for 15 minutes.
   Device memory shall retain quantity of product and sales price during power loss.

5. Security seal--apply wire security seal to secure adjusting mechanism (if applicable) .....G-UR.4.5., S.3.5.

   Note on the official report the number of gasoline gallon equivalents of product dispensed during the test.

   After all equipment at a location has been tested, review results to determine compliance with equipment maintenance and use of adjustments ..... G-UR.4.1., G-UR.4.3.

Discussion/Conclusion: The Sector reviewed the procedures and generally concurred with the proposal. One member questioned if the references to user requirements in EPO 28 should be added to Publication 14. The Sector agreed that the test criteria presented should be added to Publication 14 after an editorial review to determine if all the references to User Requirements are appropriate.

13. Acceptable Symbols or Wording to Identify Unit Price, Total Price, and Quantity on a Retail Motor-Fuel Dispenser (Carry-Over Item)

Source: Maryland NTEP Laboratory

Background: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories requested guidance on what are acceptable symbols or words to identify the unit price, total sale, and quantity delivered on a retail motor-fuel dispenser. The laboratories recommended that the question be added to the 2002 Measuring Sector Agenda.

At the 2002 Sector Meeting a work group was formed to address this issue. The Sector agreed to consider the recommendations of that work group at the 2003 Sector Meeting

Discussion/Conclusion: No input was received from the work group assigned to develop this issue. The Sector noted that a proposal by the WWMA in September 2003 to amend G-S.5.6. Recorded Representations and expand Table 1. Representation of Units to include additional units of measure was submitted as a developing issue to the NCWM S&T Committee. The Sector agreed that Item 13 should be removed from the Sector agenda. The Sector also agreed to review the developing issue if and when the NCWM S&T requests Sector input.

14. Remove Section 3.37. Mass Flow Meters from Handbook 44 and Assimilate Relevant Sections into Other Codes (New Item)

Source: California NTEP Laboratory

Background: Many of the requirements in the Mass Flow Meters Code are the same as the requirements in the codes for other meter types. The submitter estimates that 80 % of the Mass Flow Meters Code duplicate requirements that exist in other codes. Handbook 44 could be simplified by assimilating the Mass Flow Meters Code into other existing codes. For

type evaluation it could also eliminate some questions as to what could apply when a mass flow meter is being evaluated in an application that typically is covered by another code, such as a mass flow meter installed on a truck for dispensing liquefied petroleum gas.

Recommendation: Assimilate relevant subsections of Section 3.37, Mass Flow Meters Code of Handbook 44 into the following Sections:

3.30. Liquid-Measuring Devices;
3.31. Vehicle-Tank Meters;
3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices;
  a. Hydrocarbon Gas Vapor-Measuring Devices;
  b. Cryogenic Liquid-Measuring Devices;
  c. Milk Meters;
  d. Water Meters.

For Example:

Section 3.30. Liquid Measuring Devices

A.1. - This code applies to:

(a) devices used for the measurement of liquids, including liquid fuels and lubricants, ~~and~~
(b) wholesale devices used for the measurement and delivery of agri-chemical liquids such as fertilizers, feeds, herbicides, pesticides, insecticides, fungicides, and defoliants~~.~~, and
(c) devices that are designed to dynamically measure the mass, or the mass and density of liquids.

Section 3.31. Vehicle-Tank Meters

A.1. - This code applies to:

(a) meters mounted on vehicle tanks including those used for the measurement and delivery of petroleum products or agri-chemicals such as fertilizers, feeds, pesticides, defoliants, and bulk delivery of water.
(b) devices mounted on vehicle tanks that are designed to dynamically measure the mass, or the mass and density of liquids.

The Sector was asked to consider forming a work group to analyze this proposal and develop a recommendation for consideration at the next Sector meeting.

Discussion/Conclusion: The Sector reviewed the proposal and noted that there is already an item on the agenda of the NCWM S&T Committee proposing that the entire Handbook 44 be reviewed for possible reorganization. The Sector agreed to recommend to the NCWM through the NTEP Committee that the entire Liquid Measuring Devices Section of Handbook 44 should be reorganized and combined wherever possible.

15. Reports of Work Groups (New Item)

Source: Mike Keilty (Endress+Hauser)

Background: Work groups are effective tools that allow agenda items to be developed between meetings. However, some items fail to be developed because there is such a long span between the yearly meetings and there is not always a good commitment to work on the item.

Recommendation: Require that a work group team leader provide a status reports to Steve Patoray (NTEP Director), Richard Suiter (NIST Technical Advisor), and the Measuring Sector Chairman. Reports must be forwarded on January 15th and April 15th following the October Measuring Sector meeting.

Discussion/Conclusion: The Acting Chairman, Mike Belue (Belue Associates) recommended that an additional reporting date of August 15th be added. There were no additional comments on this item. The Sector agreed with the item as amended.

16. Next Meeting

The Sector discussed the time and location for its next meeting.

Discussion/Conclusion: The Sector agreed to recommend that the next Sector Meeting be held in conjunction with the SWMA Annual Meeting tentatively scheduled to be held in Mississippi in October 2004.

Appendix D

Weighing Sector Summary

Fresno, California
September 11-13, 2003

Carryover Items

1. Policy for Initial Test Only vs. Full Evaluation when a Modification is made which Requires Testing

Source: 2002 Weighing Sector Item 6

Background: See 2002 Sector Summary Agenda (Appendix F, Item 6, of the 2003 NTEP Committee Annual Report) for additional background information.

The NTEP director reported that NTEP has been implementing the 2001 Sector recommendation that the applicant for a modification of a CC agree in advance with the NTEP director and, if possible, the Participating Laboratory that performed the original evaluation on the device(s), that said device(s) be submitted for testing. The Sector agreed that a documented policy would promote uniformity among the labs and provide advanced notification to NTEP applicants if the policy were published in Pub 14.

The draft guidelines SMA is developing could be used to assist the NTEP director and labs on the extent of re-evaluation needed for modification.

It was also suggested that a minimum list of metrologically significant components (MSCs) be developed with a statement relating to a minimum amount of re-evaluation associated with each component. A consensus could be gathered using information from the NTEP director, participating laboratories, original equipment manufacturers (OEMs).

Recommendation: The NTEP Committee should consider the following underlined amendments for Publication 14, NTEP Administrative Policy, paragraph D.2.:

D.2 Responsibility for Reporting Occurrence of Modification

b. NTEP Options

On the basis of the manufacturer's notification, NTEP will decide whether or not to require an evaluation for approving the modification or issuance of a new Certificate of Conformance (CC). When a metrologically significant modification is to be made to a device with an existing CC, the manufacturer and NTEP shall attempt to agree upon the extent of reevaluation that might be required before such modification is made. In the event of a disagreement, a full reevaluation shall take place. NTEP will notify the manufacturer accordingly.

NTEP's decision can be appealed to the NCWM Board of Directors according to NCWM Publication 14 Administrative Policies, Section T. Appeal and Review Process.

Additionally, SMA Guidelines were to be to be submitted to the Sector by the middle of May 2003 for consideration at the next Sector meeting.

Discussion: **T**he Sector was updated on the NTEP Committee's position on the above recommendation. The NTEP Committee rejected the above proposal because the statements "shall attempt to agree" and "in the event of a disagreement, a full evaluation shall take place" were too negative and did not leave NTEP with the flexibility to make alternate decisions if an agreement could not be reached with the applicant.

Many SMA members believe there is no problem with the recommendation of the 2001 Weighing Sector and the language being developed by the SMA is intended to be used as a guideline and should not be construed as a policy.

Other Sector members noted that a policy is needed for requiring additional permanence testing for devices submitted for amending a certificate. The manufacturers want to know the kinds of modifications to the type that will require additional permanence testing and what parts of previous evaluations can be used to demonstrate compliance of the modified type. The Sector reaffirmed the belief that a documented guideline or policy, along with a list of MSCs, would help NTEP treat all applicants equitably and allow applicants to correctly anticipate the time and expense of a reevaluation. The list of

MSCs will also be required as an element of the NCWM/NTEP Conformity Assessment Program. Such a list would also be helpful for applicants of other device types.

Conclusion: The Sector concluded that a policy guideline is needed to determine the necessity of a partial or full evaluation to amend an existing certificate. The Sector further agreed that the policy being developed by SMA should be part a technical policy in Publication 14 and not an NTEP Administrative policy. The SMA technical committee will continue to develop its DRAFT guidelines for ultimate review by the Sector and NTEP Committee. The Sector chairman volunteered to be the lead person on this item. The Sector also agreed that the document will not be all-inclusive and will be amended when clarifications are needed to recognize additional examples of modifications to MSCs.

2. Vehicle Scale Testing Procedures

Source: 2002 Weighing Sector Summary Agenda Item 16

Background: See 2002 Weighing Sector Summary (Appendix F, Item 16 of the 2003 NTEP Committee Annual Report) for complete background details. Based on the 2002 discussion, the participating laboratories amended the vehicle scale test procedures to provide additional clarity and promote the uniform application of test weights and test loads.

Questions remained, however, on the amended procedures including questions on strain-load test procedures. Manufacturers were concerned about conducting a 5-point increasing-load test in conjunction with the shift test. For scales with a large concentrated load capacity (CLC) rating, this represents a lot of weight on the scale for a long time and increases the possibility of a zero change due to creep. Publication 14, Chapter 1, Section 65a.4.5. *Strain-Load Test* recognizes that consideration must be given for the length of time the load is on the scale and possible temperature changes that may occur during the test. The same notation will be added to Section 65a.3. *Shift Tests* in the 2003 Edition of Publication 14. This item was carried over to the next meeting of the NTEP Participating Laboratories and the NTETC Weighing Sector for further clarification.

The 2002 Weighing Sector agreed to support the proposal developed by the participating laboratories with clarification and recommended amendments to Publication 14, Chapter 1, Section 65(a) 3.1. through 65(a). 3.3.

This item was further discussed at the April 2003 NTEP weighing laboratories' meeting. A problem continues with interpreting the information contained in the sections regarding vehicle scale testing. It is not clear how many load sequences need to be completed and what increments are needed. Also, it is not clear how to conduct the strain test. There also appears to be some question about the amount of weight and testing sequence for permanence testing.

Manufacturers are concerned about the cost in both time and money for device evaluations. Also, NTEP labs need to interpret the requirements consistently. To achieve this goal, the labs agreed to develop a final test data sheet. Bill West, Gary Castro, Don Onwiler, and Steve Cook were assigned to develop test reports.

Steve Cook drafted amendments to the "shift and strain-load test language" for Publication 14 as shown in the attachment for Item 2. The labs considered amending the number of steps for the increasing/decreasing-load tests but could not agree on a specific number and requested technical input from vehicle scale manufacturers on the value of the information gathered in the number of test loads.

Discussion: Many manufacturers expressed concern that the term "creep recovery" is not defined. It was explained by the NTEP director and confirmed by the manufacturers that problems with returning to a zero-balance condition after a load has been on the scale for a period of time is more likely due to temperature changes rather than "creep." It was suggested that the term "creep recovery" be removed from the proposed language. If there was a problem returning to zero that exceeded the amount allowed over a change in ambient temperature, it was suggested that a more specific test be conducted by placing a load on the scale for 30 minutes. After that time, remove the load and the scale should return to zero within 30 minutes. There was also a recommendation that certified thermometers with a 1 ºF (0.5 ºC) resolution be used to verify and record ambient temperatures near the middle of the scale where the load cell cable leaves the load-receiving element.

Significant discussion centered on the number of steps to be performed while conducting the strain-load test. Some laboratories stated there have been problems revealed with non-linearity by conducting the shift test with five test loads

and that shift tests conducted with five test loads are appropriate. Another laboratory agreed with the manufacturers that non-linearity is predictable and would have already been demonstrated during the shift tests. A straw poll of the voting members indicated that the majority of the sector members were against conducting the strain-load test with five test loads.

A request was made for clarification regarding the test pattern for the test weights used for the strain-load test. Publication 14 states that the test weights used to conduct the shift test are to be used for the strain-load test. Some of the labs apply the weights in the same test pattern and test load used to verify the CLC rating. Concern was expressed about overloading the weighbridge of the scale when a test load of 90 % CLC is added in the prescribed test pattern and located close to the unknown load. The Sector agreed that the test weights used for the strain-load test could be distributed over the available area on the end of the scale not occupied by the object used for the unknown load.

The Sector decided that additional clarification was needed to specify the specific tests that would be repeated for the permanence test, and that it would take place after 20 days' use with minimum use requirements having been met.

Discussion also ensued regarding a proposal to increase the amount of test weights needed for the permanence test to that used for the initial test. The lab that proposed this justified its position by stating that the existing test procedures did not test the permanence of the CLC rating. Furthermore, the initial testing could be immediately restarted if the scale failed permanence tests. The Sector discussed this issue previously and established the current policy at its June 1988 meeting. The current laboratory proposal did not include sufficient justification for changing the policy. The manufacturers stated there was no benefit that justified the expense of bringing in the additional weights. Additionally, they stated that there is a design or repair problem that must be addressed before the tests can be restarted after a permanence test failure. They further stated that permanence tests demonstrate that the scale can maintain tolerances and do not consider an amount in shift between tests an error as long as it maintains tolerances.

Conclusion: The Sector recommended the following:

1. Include temperature-recording procedures and guidelines in the proposed amendments to the "shift and strain-load test language" in this item.
2. Remove the term "creep-recovery" in the proposed amendments to the "shift and strain-load test language" in this item.
3. Add: "If the device does not return to zero and the temperature has not changed, the scale must indicate zero within tolerance within 30 minutes" in the proposed amendments to the "shift and strain-load test language" in this item.
4. Amend the NOTE in section 65.a.2.1 that clarifies that the shift test with a test load of 90 % to 100 % CLC located at the mid-section between spans only has to be conducted one time.
5. Ballot the Sector on the amended strain-test language that removes the requirement that test weights have to be applied in five steps.
6. Amend the language in the proposed strain-load test procedures to state that test weights do not have to be concentrated in the shift test prescribed test pattern as described in Handbook 44 paragraph N.1.3.4. (a).
7. Amend the proposed strain-load test language into individual steps.
8. Retain current test weight requirements for the subsequent permanence tests.
9. Amend section 65a.5 that weights should be applied and recorded at a minimum of three steps for subsequent tests.

The Sector further recommends the following <u>underlined</u> language replace the existing language in Publication 14, Checklist for Digital Electronic Scales, Sections 65a.2 through 65a.5:

(NOTE to the Editor – Add the following language from paragraph 65a.6. to the end of paragraph 65a.)

<u>Caution Regarding Load Concentration</u>

<u>Concentrating large loads on scale platforms by using weight carts or test equipment using hydraulic jacks may exceed the maximum pound-per-square inch load specification for the deck. This condition may arise because the small tire area of the weight cart in contact with the deck surface could result in a very large load concentration over an unusually small area. This could cause damage to the scale deck.</u>

This situation may occur with a weight cart having a very narrow or short wheelbase and small solid rubber tires. This may cause a problem on steel plate decks and could also result in damage to manhole covers. If the load capacities of weight carts increase beyond 25 000 lb, while maintaining solid tread wheels, it is possible that some concrete decks could be damaged.

65a.2. Shift and Section Tests (Initial Performance Testing)

(Note To Editor: Delete existing Pub 14 language and replace with the following language.)

A **shift test** is defined in Handbook 44 as a test intended to disclose the weighing performance of a scale under off-center loading. [2.20]

A **section test** is defined in Handbook 44 as a **shift test** in which the test load is applied over individual sections of the scale. This test is conducted to disclose the weighing performance of individual sections, since scale-capacity test loads are not always available and loads weighed are not always distributed evenly over all main load supports. [2.20]

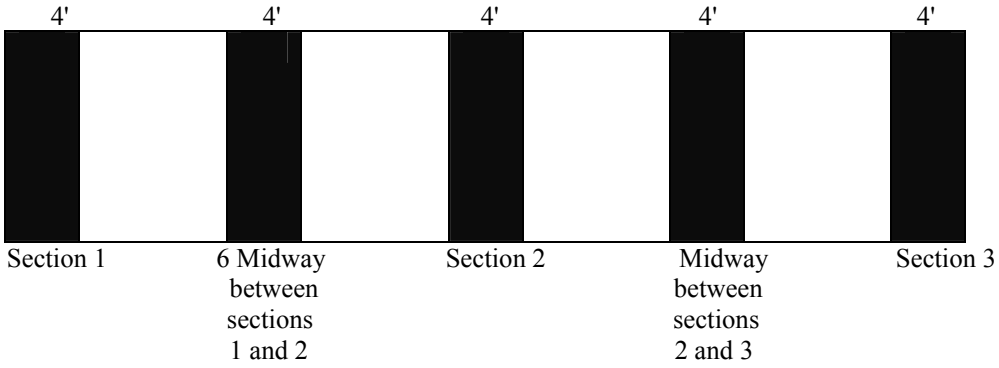
The minimum amount of *test weights* to conduct the shift and section tests 90 % of the CLC.

Record the time and temperature at the beginning and end of each complete shift test. The location of the temperature probe should be at a point near where the load cell cable leaves the load-receiving element. The temperature probe shall have a resolution no greater than 1 ºC, (2 ºF) and shall comply with NIST Handbook 105-6 or equivalent internationally recognized standards.

The scale shall be capable of returning to a no-load indication within prescribed limits (3d per 5 °C change in temperature) and within 15 minutes after shift and section test loads are removed.

Unless otherwise stated in the following procedure, the increasing and decreasing load tests (using known test weights) shall be conducted with at least five test loads (e.g. 500, 1000, 2000e...). (NOTE) If possible, the test first load should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.

An example of a three-section scale:



65a.2.1. Conduct at least two complete sets of shift tests over each section to at least 90 % of the concentrated load capacity (CLC) of the scale. When analyzing the return to zero, consideration must be given for the length of time the load was on the scale and possible temperature changes that may have occurred during the test.

(a) Begin the shift test by loading one end section to the first of at least five test loads and record the error.

(b) Move the test load to the next section and record the error. Repeat this step at each section until the opposite end of the scale is reached.

(c) Repeat steps (a) and (b) for each test load until at least 90 % of the CLC is reached. A minimum of five test loads is required.

(d) While at the maximum test load (90 % of the CLC) and during one of the shift tests, place the test weights at mid-span between sections and record the error.

On modular scales, conduct the shift test on the center (C), right (R), and left (L) side of each module connection line.

Section 1		Section 2 C			Section 3
1R	Mid-Span	2L	2R	Mid-Span	3L

(e) When steps (a) through (d) are complete, conduct a decreasing load test at the end of the scale where the weights can be removed. Record the error and section where this test was performed.

(NOTE to Editor: Delete Existing 65.a.3. Shift Test and renumber subsequent paragraphs.)

65a.3. Strain-Load Test (Initial Performance Testing)

(NOTE to Editor: Delete existing language and replace with the following)

The minimum amount of ***test weights*** used shall be the same loads used to conduct the shift tests.

Record the time and temperature at the beginning and end of each complete strain-load test. The location of the temperature probe should be at a point near where the load cell cable leaves the load-receiving element. The temperature probe shall have a resolution no greater than 1 ºC, (2 ºF) and shall comply with NIST Handbook 105-6 or equivalent internationally recognized standards.

The scale shall be capable of returning to a no-load indication within prescribed limits (3d per 5 °C change in temperature) and within 15 minutes after the load was removed.

Unless otherwise stated in the following procedure, increasing and decreasing loads (using test weights) shall be at a minimum of five test loads. *(NOTE) If possible, the first increment of test weights should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.*

The target strain-load test indication is the sum of the indication of the unknown weight and the amount of test weights.

The strain-load error is the difference between the actual strain-load test indication and the target strain-load test indication.

Acceptance tolerances are applied and are based on known test weights.

(NOTE: The test weights do not have to be concentrated in the test pattern prescribed in Handbook 44 Scales Code paragraph N.1.3.4.).

65a.3.1. Conduct at least one strain-load test at each end of the scale. The maximum load applied during the strain-load test shall be in the range of 80 % to 100 % of scale capacity. Distribute the load over the load-receiving element.

65a.3.2. For the first test:

(a) Load the scale with a vehicle or vehicles so the addition of test weights will provide a gross load of 80 % to 100 % of scale capacity.

(b) Record the "reference point" for the start of the strain-load test.

(c) Add the test weights to one of the ends of the scale. The target strain-load indication is the sum of the unknown weight and the test weights.

(d) Record the indicated strain-load value and calculate the strain-load test error. The scale shall perform within prescribed tolerances based upon the tolerance for the known test weights.

(e) Remove the test weights from the end of the scale without conducting a decreasing-load test.

(f) Record the new strain-load reference value and re-apply the test weights.

(g) Record the indicated strain-load value and calculate the strain-load test error. The scale shall perform within prescribed tolerances based upon tolerance for the known test weights.

Note: To verify that the strain-load values repeat the initial value, the strain-load test indication in step (g) shall agree with the strain-load test indication in step (d) within the absolute value of maintenance tolerances (repeatability).

(h) Conduct a decreasing-load test and return to the strain-load reference value as the weights are removed as part of this test cycle. Record the results of the decreasing-load test at 5 different test loads.

(i) Record the return to the strain-load reference value. This value shall be within one-half of a scale division of the values recorded in (b) considering any temperature changes that may have occurred during this last test cycle.

(j) Remove the strain-load. Do not apply zero-return tolerances at this time.

65a.3.3. For the second test:

(a) Rezero the scale.

(b) Place the strain-load (vehicles or material of unknown weight) on the other end of the scale.

(c) Record the strain-load reference value. The semi-automatic tare mechanism may be used to tare out the strain-load value (Net weight indications can be used for the increasing-load test.) Do not use the zero-setting mechanism to set the strain-load to zero.

(d) Add the test weights the other end of the scale. The target strain-load indication is the sum of the unknown weight and the test weights.

(e) Record the indicated strain-load value and calculate the strain-load test error. The scale shall perform within prescribed tolerances based upon tolerance for the known test weights.

(f) Remove the strain-load (vehicles or material of unknown weight) but leave the known test weights on the scale and set the indicator to display “gross weights.”

The gross weight indication of the test weights shall be within acceptance tolerances.

(g) Use the "gross weight" indications to conduct a decreasing-load test. Record the decreasing-load test in 5 different test loads.

(h) When all the weights are removed, record the return to zero. The scale must return to zero within one-half of a scale division considering any temperature changes during this test cycle.

65.a.4. Minimum Use Requirements prior to Subsequent Test for Permanence

- A minimum of 300 weighing operations are required during the test period. If the test site is at the applicant's or manufacturer's location, the applicant or manufacturer is to log the date, time, and weight. The person conducting the weighing is to initial each testing.
- Only loads that reflect "normal" use will be counted during the permanence-testing period.[1]
- For vehicle scales with a nominal capacity over 75 000 lb:
  - 50 % of the loads must be above 50 000 lb or 80 % of the CLC, whichever is greater; and
  - 100 % of the loads must be above 20 000 lb or 50 % of the CLC, whichever is greater.
- For all other scales:
  - 50 % of the loads must be above 50 % of the scale capacity; and
  - 100 % of the loads must be above 20 % of the scale capacity.
- Substitution or strain-test loads for the minimum use requirements are acceptable as long as all above conditions are met.
- The minimum number of days that a device is required to be in use is 20. A minimum number of weighing operations to be conducted each day for the test period is not specified; however, the weighments should represent the scale's normal in-service use.

(NOTE to Editor: Replace existing 65a.5. Subsequent Type Evaluation (Field) Permanence Tests and replace with the following language.)

65.a.5 Subsequent Type Evaluation Tests for Permanence

The minimum amount of ***test weights*** for the shift and strain-load tests shall be a minimum of 40 000 lb or 50 % of the CLC, whichever is greater.

Record the time and temperature at the beginning and end of each complete shift test. The location of the temperature probe should be at a point near where the load cell cable leaves the load-receiving element. The temperature probe shall have a resolution no greater than 1 ºC, (2 ºF) and shall comply with NIST Handbook 105-6 or equivalent internationally recognized standards.

The scale shall be capable of returning to a no-load indication within prescribed limits (3d per 5 °C change in temperature) and within 15 minutes after the load was removed.

Unless otherwise stated in the following procedure, increasing and decreasing-load test results (using test weights) shall be recorded at a minimum of three test loads (zero, approx. ½ maximum test weights, and at maximum test weights).

[1] The scale may be used to weigh other loads, but only the loads identified are counted as part of the permanence test.

The strain-load error is the difference between the actual strain-load indication and the target strain-load indication.

Acceptance tolerances are applied and are based on known test weight.

(NOTE: The test weights do not have to be concentrated in the test pattern prescribed in Handbook 44 Scales Code paragraph N.1.3.4.).

65a.5.1. Conduct at least one complete set of **shift** tests over each **section**, at mid-span between each **section** Increasing and decreasing tests (using known test weights) shall be conducted with at least three different test loads (near 500e, and at one-half and at maximum available test weights).

While at the maximum test load, place the test weights at mid-span between sections and record the error.

On modular scales, conduct the shift test on the center (C), right (R), and left (L) side of each module connection line.

Section 1			Section 2 C			Section 3
1R	Mid-Span	2L	2R	Mid Span		3L

65a.5.2. Conduct at least one complete set of strain-load tests using the "Strain-Load Test" procedures in steps 65a.3 through 65a.3.3. The maximum applied load shall be in the range of 65 % to 100 % of scale capacity.

65a.5.3. If the device does not meet these tolerance limits during the subsequent test for permanence (unless otherwise stated in Handbook 44, any type evaluation tests must be within acceptance tolerances), all tests described in sections 65a.1 through 65.a.5 shall be repeated.

(NOTE to Editor - Delete paragraph 65a.6 - Caution Regarding Load Concentration. Language was moved to paragraph 65a.)

(NOTE to Editor – Delete paragraph 65a.7 - Permanence Test Use Requirements. The language was moved to paragraph 65a.4 - Minimum Use Requirements prior to Subsequent Test for Permanence.)

3. Definitions of Hanging and Crane Scales

Source: 2002 Weighing Sector Agenda Item 19

Background: See 2002 NTETC Weighing Sector Meeting Summary (Appendix F) of the NTEP Committee 2003 Final Report for complete details and proposals. Due to similarities in crane and hanging scales and the fact that structure of the scale support seemed to be the main variable in the classification of the type of device, the Sector proposed consolidating the definitions of crane and hanging scales and labeling the resulting scale type "hanging" scale, deleting the definition of crane scale, removing the reference to crane scale from Table 7a. and paragraph N.1.3.8, and change remaining crane scales references to hanging scale in NIST Handbook 44

At the 2003 NCWM Interim Meeting the S&T Committee discussed the Weighing Sector's concern about the large list of terms (see Tables 7a. and 7b. of the 2002 Weighing Sector Summary in the 2003 NCWM Annual Report) used to identify various scale types and designs. The Committee questioned the existence of Class II hanging scales that may not be included in the proposed definition for hanging scale.

hanging scale. A scale designed to weigh loads while they are suspended from a hook on the scale or loads resting on a platter or platform that is suspended from the scale. Hanging scales may be any capacity and may be Class III or III L, whichever is appropriate for the intended use, as long as all parameters for the intended class are met. Sometimes called "crane scale."

The Committee believed the Weighing Sector should explore other options to consolidate the terminology used to describe scale types and designs. The Committee withdrew the proposal and referred the item back to the Weighing Sector for further development.

Discussion/Conclusion: The Sector recommended no further action on this item. The issues stated in the above background information may be resolved with changes to the procedures for the listing of device types on CCs and was further discussed during on the Sector's agenda item 13.

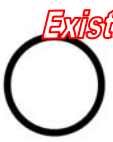
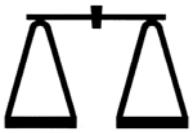
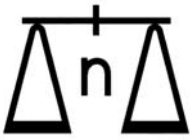
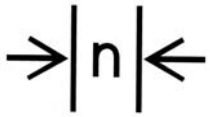
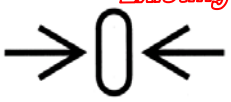
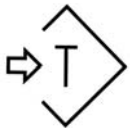
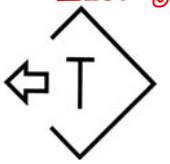
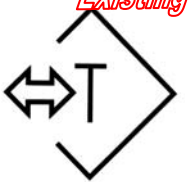
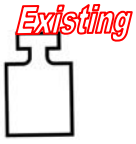
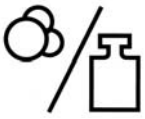
4. List of Acceptable Abbreviations and Symbols

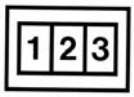
Source: 2002 Weighing Sector Agenda Item 20

Background: See 2002 Weighing Sector Summary in the NTEP Committee's 2003 Annual Report (Appendix F, Item 20) for complete background information.

Recommendation: The SMA has submitted the following symbols for discussion. The Sector was asked to review and consider the proposed table as an addition to paragraph 74 of Publication 14.

Table 1, Operational Controls, Indications, Features:

1.1  On (power)	1.2  Off (power)	1.3  On/Off (power)	1.4  Enter
1.5  Weighing	1.6  Scale n (n = 1,2, ...)	1.7  Range n (n = 1,2, …)	1.8  High resolution
1.9  Not for direct sales to the public	1.10  Zero setting	1.11  Combined zero/tare - See S.2.1.6. for additional required markings	1.12  Taring
1.13  Enter tare	1.14  Verify tare	1.15  Combined tare/clear	1.16  Clear tare
1.17  Mass/Weight	1.18  Money	1.19  Price per weight unit	1.20  Piece count

1.21  Counter	1.22  Read counter	1.23 Existing  Print	1.24  Print certificate
1.25  Information			

Discussion: The symbols are internationally accepted weighing symbols and registered with the DIN (Deutsches Institut FÜr Normung) (Germany) and IEC (International Electrotechnical Commission). There was general agreement that NTEP should recognize international symbols whenever possible. The majority of the symbols are intended to be used in the operation of the devices and would likely be defined in the operator's manuals. There were additional concerns regarding the increased number of customer-operated devices and the use of many of these symbols without additional markings or descriptions.

The Sector discussed symbols that would be available to the customer. More specifically, the symbols for indirect sales (1.9), money (1.18), and price per unit weight (1.19), are not well known in the U.S. and should not be used without additional information for the customer.

The Sector also discussed the list's lack of availability to weights and measure officials who do not have access to Publication 14 and other international documents. It was suggested that the list of symbols be made available on the NCWM and NIST web sites and that they be incorporated into weights and measures bulletins, examination procedure outlines, and inspector training modules.

Conclusion: The Sector recommends these symbols be incorporated into NCWM Publication 14. The symbols intended for the customer (including customer-operated devices) cannot be used without additional descriptions or markings on the device. Additionally, the list will include a note that the symbols should be used as a guide and that style differences are acceptable (e.g., shapes of arrows). The Sector also requests that NCWM and NIST explore the possibility of distributing the list of symbols through the use of weights and measures bulletins, web sites, examination procedures, and training information. The Sector further recommends that the list of acceptable symbols can be removed from Publication 14 upon greater customer familiarity and acceptance of the symbols.

5. Shift Testing on Multi-Interval Scales

Source: Ohio Participating NTEP Laboratory

Background: See 2002 Weighing Sector Summary (Appendix F, Item 21 of the 2003 NTEP Committee Annual Report) for complete background information.

Bill West and Darrell Flocken submitted the following proposed language for Publication 14 DES Checklist Section 31 Multi-Interval Scales. The Sector was asked to review and comment on the proposed language and provide the NTEP Committee with recommendations to amend Publication 14.

31. Multi-Interval Scales

A multi-interval scale is an instrument having one weighing range that is divided into partial weighing segments. Each weighing segment is defined by its division size, its minimum capacity, and its maximum capacity. The selection of the appropriate weighing segment is determined automatically according to the load applied, both on increasing and decreasing loads. The shift test shall be conducted at one-half the capacity of the scale. Corner tests, if appropriate, shall be run at one-quarter of the scale capacity. The number of scale divisions, *n*, for each

weighing segment is determined by dividing the maximum capacity of the weighing segment by *e* of the same weighing segment. In the case of multi-interval scales, *e* must be equal to *d* (see S.5.3.).

Example:

Weighing segment				
Minimum Capacity	Maximum Capacity	*e*	*n*	
0 kg	3 kg	1 g	3000	(3000/1)
3 kg	6 kg	2 g	3000	(6000/2)
6 kg	15 kg	5 g	3000	(15000/5)

The number of divisions for each weighing segment must meet Table 3 of the Scales Code. The capacity and verification scale division must be conspicuously marked near the weight display.

Since weighing segments on a multi-interval scale may not overlap, the capacity statement for each weighing segment and the weight in the weight display is a sufficient indication of the weighing segment in use.

A multi-interval scale shall operate as follows:

- The motion detection requirement must be satisfied for each scale division (see S.2.1.5.).
- The division size for the first weighing segment applies to the tests to determine the width of zero and the amount of the automatic-zero setting mechanism.
- The scale division must change when a lower weighing segment reaches its maximum value so that rounding occurs properly and the number of displayed decimal places does not change within the same weight indication.

  Example: Suppose a scale has the following weighing segments:

  Capacity: 0 lb. to 10 lb x 0.005 lb
  10 lb. to 30 lb x 0.01 lb

  The scale indication for a 10-lb load must be 10.00 lb, not 10.000 lb. Once the scale has exceeded an internal weight indication of 9.9975 lb, it must round to the next higher weight indication. If 10.000 lb were to be indicated, a load perceived internally as 10.003 lb would result in the scale indicating in some manner that it is no longer sensing 10.000 lb $\pm$ 0.0025 lb; hence, it would then indicate 10.00 lb. This round-off problem is avoided by causing the scale to indicate 10.00 when sensing a load in excess of 9.9975 lb (based upon its internal resolution). The scale will continue to indicate 10.00 lb until its internal resolution senses a load in excess of 10.005 lb, whereupon the weight display will update to 10.01 lb.

- There are several considerations regarding the proper operation of tare on multi-interval scales.

  - All tares must be taken in the minimum increment. Therefore, the maximum tare allowed is the maximum capacity of the smallest weighing segment.
  - Whenever gross and tare weights fall in different weighing segments, (hence the scale divisions for the gross and tare weights differ), the net weight must be in mathematical agreement with the gross and tare weights that are indicated and recorded (i.e., net = gross - tare).
  - Manually entered keyboard, thumb-wheel, and digital tare values must be entered to the displayed scale division.

  In applying these principles, it is acceptable to:

  - round the tare value (in the upward direction) to the appropriate net weight scale division.

  - or display net weight values in scale divisions other than the scale division used in the display of gross weight, as when the gross and tare weights are in different segments of the device. For

example, a scale indicating in 2-lb divisions in the lower segment and 5-lb divisions in the next higher segment may result in net values ending in three or eight in the higher segment.

In every case, it is required to maintain the mathematically correct equation:

net + tare = gross.

31.1. The requirements specific to multi-interval scales, such as the displayed scale division, the operation of tare, and the mathematical agreement of gross, tare, and net values, depend on the information that can be displayed or recorded by the weighing system and may be summarized as follows:

31.1.1	The number of scale divisions in each weighing segment must meet Table 3 of the Scales Code.	Yes □	No □	NA □
31.1.2	For all weighing segments, *e* must equal *d*.	Yes □	No □	NA □
31.1.3	The scale division for gross and positive or negative net weights for both increasing and decreasing loads must be displayed in scale divisions consistent with the weighing segment in which the weight falls.	Yes □	No □	NA □
31.1.4	Weight indications at the break-over point of weighing segments must be displayed properly.	Yes □	No □	NA □
31.1.5	Tare may be taken to the maximum capacity of the smallest weighing segment of the scale.	Yes □	No □	NA □
31.1.6	Keyboard tare entries must be consistent with the displayed division size. Incorrect entries may be rounded to the displayed scale division or rejected.	Yes □	No □	NA □
31.1.7	Devices equipped with a tare capability must at all times indicate and record values that satisfy the equation net = gross - tare.	Yes □	No □	NA □
31.1.8	Devices equipped with push-button tare must meet the tolerances for net loads for any tare value.	Yes □	No □	NA □
31.1.9	Scales that display or record only net weight values (e.g., most computing scales)			
	▪ may take tare values to either the internal resolution or the displayed scale division.	Yes □	No □	NA □
	▪ must always begin with the lowest weighing segment on the device regardless of the amount of tare that is taken.	Yes □	No □	NA □

Discussion: The Sector reviewed the languages submitted by Bill West and Darrell Flocken and generally agreed that the proposed language should be incorporated into Publication 14. The Sector was concerned with the definition of multi-interval scale in Handbook 44 and believed the definition was a possible source of the current confusion surrounding the application of shift test loads on multi-interval and multiple-range scales. NIST Handbook 44 Appendix D, Definition, states that a multi-interval scale is "a scale that has one range divided into partial ranges with different intervals for each partial weighing range". This is frequently confused with a multiple-range scale, which is a scale that has more than one range with different intervals for each range. The language submitted by Darrell Flocken and Bill West recommended replacing the term “partial weighing range” with “partial weighing segment” in order to further highlight the differences between the two type of scales.

Conclusion: The Sector agreed to recommend the above language for incorporation into Publication 14. The Sector also recommends that the definition of multi-interval scale be amended to highlight the differences between multi-interval and multiple-range scales. The Sector asked the NIST technical advisor to develop amended language for the definition of multi-interval scale that can be submitted to the NCWM Specifications &Tolerance Committee.

Note: After the meeting, NIST technical advisor to the Weighing Sector (WS) discussed the above recommendation with the NIST technical advisors to the NCWM Specifications and Tolerance Committee (S&T). They could not support replacing the term "partial weighing range" with "partial weighing segment" in Handbook 44 since there was insufficient justification to amend the original definition that is based upon international terminology. However, the technical advisors (WS and S&T) agreed that the definition could be amended editorially by inserting the term "segment" as a parenthetical equivalent for "partial weighing range" as follows:

> **multi-interval scale.** A scale having one weighing range which is divided into partial weighing ranges (segments), each with different scale intervals, with the weighing range (segment) determined automatically according to the load applied, both on increasing and decreasing loads.

6. Inconsistent Information on a CC

Source: 2002 Weighing Sector Item 23

Background: See 2002 Weighing Sector Summary (Appendix F, Item 23, of the 2003 NTEP Committee Annual Report) for complete background information. This subject of including peripheral equipment in the test condition section of a CC was addressed during the 1992 Weighing Sector meeting, but the recommendation was never incorporated into the Pub 14. Section "Models". (See June 1992 Weighing Sector Summary [Item 6] for additional information.)

The June 1992 Sector Summary was reviewed, and the 2002 Sector reconfirmed that non-metrological accessories and peripheral equipment (printing elements, video displays, etc.) used as part of the evaluation should be listed in the "Test Conditions" paragraph as verification that metrological features such as indicated and recorded representations have been evaluated. Additionally, the Sector reconfirmed that the CC does not limit the use of non-metrological peripheral equipment to those listed.

The Sector recommended that the following underlined language be added to the NTEP Publication 14 Administrative Procedures in paragraph P. Certificate of Conformance to facilitate consistent information included on the Certificate of Conformance.

> P.6. CCs should detail the main elements, load cells, and auxiliary devices used during an evaluation, including model designation and other significant parameters, under the "Test Conditions" portion of the CC. Only the standard features and options that have been evaluated will be included on the CC.

At the January 2003 NCWM Interim Meeting, the NTEP Committee considered the above recommendation. The Committee did not agree with the Weighing Sector and stated that the recommended policy does not affect the administration of NTEP and should be considered as a technical policy. The Committee recommended the participating laboratories and Weighing Sector reconsider the item during the 2003 meeting of the NTETC Weighing Sector. As a response to the NTEP Committee decision, the NIST technical advisor submitted the following addition to Publication 14, Chapter 1, NTEP Technical Policy for Scales for consideration by the Sector *(**Note:** Similar language should be submitted to the other Sectors for consideration.)*:

> **B. Certificate of Conformance Parameters**
>
> **Certificates of Conformance (CC) should detail the main elements, load cells, and auxiliary devices used during an evaluation, including model designation and other significant parameters, under the "Test Conditions" portion of the CC. Only the standard features and options that have been evaluated will be included on the CC.**

The following guidelines apply . . .

Discussion: The Sector supported that language developed by the technical advisor and recommended that the proposed language should ***require*** that CCs detail the main elements by using the term "shall detail" instead of "should detail." Additionally, the Sector recommended that the first paragraph in Section A. Models to be Submitted for Evaluation should be amended to state that the non-metrological features may be listed on the certificate provided they have been "evaluated" to operate as intended since the use of the term "tested" implies that specific tests were conducted. One of the Sector members stated that non-metrological functions should not be listed on a CC and stated that is should be considered during a future meeting of the NTETC Weighing Sector.

The Sector also addressed how to handle existing CCs that listed unnecessary or inadequate information on the certificate. The NTEP director noted that eventually all active certificates would be updated as the NTEP Conformity Assessment Program evolves.

Conclusion: The Sector recommends that NCWM Publication 14, NTEP Policy for Scales, Section A be amended as follows:

A. Models to be Submitted for Evaluation

A type is a model or models of the same design, as defined in the NTEP Policy and Procedures. A complete list and description of all models of a type to be included on the Certificate of Conformance (CC) shall be submitted with the request for type evaluation. All options and features to be included on the CC must be submitted for evaluation. Non-metrological features may be listed on a CC, but only if the feature has been evaluated ~~tested~~ and operates as intended. If the CC is to include more than one model of the same type, the applicant shall contact the evaluation agency to determine which model or models will be evaluated. A CC will be amended when the manufacturer adds new models of the same type meeting the specified criteria ~~new models of the same type meeting the specified criteria are added by the manufacturer~~.

Applicants of remanufactured weighing devices and load cells are reminded that any device submitted for evaluation shall comply with all applicable requirements in Handbook 44, including non-retroactive requirements, as if it were a newly manufactured device. All references to "device(s)" are considered to include remanufactured device(s).

B. Certificate of Conformance Parameters

A Certificate of Conformance (CC) shall detail the main elements, load cells, and auxiliary devices used during an evaluation, including model designation and other significant parameters, under the "Test Conditions" portion of the CC. Only the standard features and options that have been evaluated will be included on the CC.

The following guidelines apply . . ..

7. Submission of Scales with Nominal Voltages of 85 to 240 VAC to NTEP

Source: 2002 Weighing Sector Agenda Item 24

See agenda item 14d for specific language and suggested Publication 14 test procedures.

Discussion/Conclusion: The Sector agreed to discuss this item in conjunction with 2003 Weighing Sector Agenda Item 14d.

8. Audit Trail Information during Power Failure

Source: 2002 Weighing Sector Agenda Item 25

Background: See 2002 Weighing Sector Summary (Appendix F, Item 25 of the 2003 NTEP Committee Annual Report). Based on the agreement at the 2002 Weighing Sector meeting, Bill West (OH) and Joe Raspino (CA) developed the following proposed changes to Publication 14 for digital electronic scales (text with the double underline have been added by the NIST technical advisor):

10. Provisions for Sealing of Adjustable Components or Audit Trail

Code Reference S.1.11.

Audit Trails – General (page DES-27)

10.5 After changes have been made to configuration and/or calibration, while still in the configuration or calibration mode, interrupt the power to the device. The event counters should not increment unless the changes are accepted by the device.	Yes ☐	No ☐	NA ☐

Renumber remaining paragraphs.

19. Facilitation of Fraud - Appropriate Design (page DES-43)

Code References: G-S.2 and G-S.5.1.

Power Interruptions

After a momentary (up to ten seconds) power interruption, an indicating element shall either return to zero, display an accurate weight value (gross or net) that is within one division of the value that was displayed before the power failure (relative to the gross load zero reference that existed prior to the power interruption and assuming no change in load), display an error signal, or display meaningless information that cannot be interpreted as a weight value and which requires operator intervention to return the scale to operation. Examples of meaningless information are ----, EEE, 6CE1, etc. Information stored in non-volatile memory (e.g., inbound weights and uncompleted transactions) shall not be lost during a power failure or when system is restarted.

The audit trail event counters should not increment after a power interruption if changes have been made to the calibration and/or configuration parameters but not accepted **by the device. Alternatively, the counters shall increment after a power interruption if the** device accepts **the changes. It has been found in some devices the changes are stored temporarily but the audit trail counters do not increment until the operator exits from the set-up mode. In this case the audit trail counters possibly may increment but the changes may not be applied or accepted by the device after a power interruption.**

Discussion: The Sector agreed with the problems identified by the participating laboratories and reviewed the language above-submitted language and agreed the term "should" be replaced by "shall" in the proposed paragraph 10.5, the statement should be consistent with Publication 14 "General Requirements for Metrological Audit Trails, and the statement should also be rephrased so that it is a positive statement.

Conclusion: The Sector recommends that NCWM Publication 14, NTEP Policy for Scales, Section K, paragraphs 10.5 and 19 be amended as follows:

10. Provisions for Sealing of Adjustable Components or Audit Trail

Code Reference S.1.11.

Audit Trails – General – Add a new paragraph 10.5 and renumber remaining paragraphs.

10.5 After changes have been made to configuration and/or calibration, while still in the configuration or calibration mode, interrupt the power to the device and exit the calibration or configuration mode.

Verify that the device has accepted the changes and that the event counter shall incremented. Yes☐ No☐ NA☐

19. Facilitation of Fraud - Appropriate Design

Code References: G-S.2 and G-S.5.1.

Power Interruptions

After a momentary (up to ten seconds) power interruption, an indicating element shall either return to zero, display an accurate weight value (gross or net) that is within one division of the value that was displayed before the power failure (relative to the gross load zero reference that existed prior to the power interruption and assuming no change in load), display an error signal, or display meaningless information that cannot be interpreted as a weight value and which requires operator intervention to return the scale to operation. Examples of meaningless information are ----, EEE, 6CE1, etc. Information stored in non-volatile memory (e.g., inbound weights and uncompleted transactions) shall not be lost during a power failure or when system is restarted.

The audit trail event counters should not increment after a power interruption if changes have been made to the calibration and/or configuration parameters but not accepted **by the device. Alternatively, the counters shall increment after a power interruption if the** device accepts **the changes. It has been found in some devices the changes are stored temporarily but the audit trail counters do not increment until the operator exits from the set-up mode. In this case the audit trail counters possibly may increment but the changes may not be applied or accepted by the device after a power interruption.**

9. Performance and Permanence Testing

Source: 2002 Weighing Sector Agenda Item 26

Background: See 2002 Weighing Sector Summary (Appendix F, Item 26 of the 2003 NTEP Committee Annual Report). As directed, Editorial corrections were made as agreed and directed and submitted to the NTEP Committee for its acceptance prior to publishing the 2003 edition of Publication 14.

Discussion/Conclusion: The Sector agreed no further action was required.

10. Range of IZSM on Indicating Elements

Source: 2002 Weighing Sector Agenda Item 29

Background: This item was carried over from the 2002 meeting of the Weighing Sector due to lack of time to complete the review and discussion. See the 2002 Weighing Sector Summary (2003 NTEP Committee Report, Appendix F, Item 29) for complete background information.

Discussion: At the 2002 Weighing Sector meeting, some manufacturers stated that IZSM on separable indicating elements is just an electronic starting point and there should be no performance difference settings up to 100 %. The manufacturer of the load-receiving element has the responsibility to make its device perform with the maximum live and dead load (i.e., a 100-lb load-receiving element with a 500-lb load cell).

At the 2003 Weighing Sector meeting, the Sector reviewed Measurement Canada's requirements and OIML R76. Measurement Canada limits IZSM on separable indicating elements to 20 % of the configured scale capacity. Discussions included the difference between scale adjustments to configure the initial dead-load calibrations and changes to the dead load that involve temporary additions to the load-receiving element. For example, changing the dead load on a vehicle scale due to an accumulation of mud or debris can be balanced off by the IZSM. Another manufacturer stated that adding a conveyor system to a scale that exceeds 20 % of the scale capacity should be allowed. The manufacturer

can choose to either have the load-receiving element evaluated to handle the additional dead load or reduce its weighing capacity by the weight of the added conveyor system.

Some of the manufacturers stated that they need to set dead-load values with limits greater that 20 % of the scale capacity. The manufacturers did not want the limitations because a restriction would limit their flexibility to mix and match compatible elements. Other Sector members stated that using IZSM above that 20 % limitation could metrologically affect the performance of a scale that has not been designed for large dead loads. Other manufacturers stated the dead load offset greater than 20 % scale capacity are rare and could be part of the "coarse zero" adjustments in the configuration of a scale.

The NTEP director stated this feature should be considered a sealable parameter according to the guidelines set out in the discussion of sealable parameters in Publication 14 "Philosophy for Sealing." The incompatible use of the feature may result in fraud (inaccurate measurements) not easily detected or affecting the device's compatibility with load-receiving elements that may or may not be designed to handle additional dead load above 20 % capacity. Other Sector members stated that additions to a load-receiving element that exceeds 20 % of the scale capacity should be considered a modification of type unless the net capacity is reduced by the amount of the added dead load or the load-receiving element has been type evaluated to accommodate initial zero load that exceeds 20 % of the maximum capacity.

Conclusion: The Sector recommends that Publication 14, Part K, Section 10, Table of Scale Features and Parameters be amended as follows to include language that IZSM separable indicating elements with IZSM adjustments above 20 % of the configured scale capacity be considered a sealable parameter:

Scale Features and Parameters	
Typical Scale Features to be Sealed	**Typical Scale Features and Parameters Not Required to be Sealed**
Coarse zero Initial Zero-Setting Mechanism (IZSM) on separable indicating elements with limits that **can** be adjusted more than 20 % beyond the maximum capacity of the load-receiving element Span Linearity correction values Motion detection (on/off) Motion detection (number of divisions and speed of operation) Number of samples averaged for weight readings Averaging time for weight indications Selection of measurement units (if internally switched and not automatically displayed on the indicator) Division value, d Number of scale divisions, n Range of over capacity indications (if it can be set to extend beyond regulatory limits) Automatic zero-setting mechanism (on/off) for bulk-weighers hopper scales and all Class III L devices Automatic zero-setting mechanism (range of a single step) 1/4 and 1/2 lb pricing capability or multiplier keys Weight Classifier mode (enabled/disabled) Manual Gross Weight Entries (enabled/disabled) for applications where this feature is not permitted in Handbook 44	Automatic zero-setting mechanism (Selection of total range, e.g., 4 % or 100 % of capacity) IZSM on separable indicating elements with limits that **cannot** be adjusted more than 20 % beyond the maximum capacity of the load-receiving element Display update rate Weigh-in/weigh-out operation (on/off) Stored tare weight capability (e.g., computing scales and vehicle weight by information number) Selection of tare feature operation, e.g., keyboard or push-button tare (on/off) Product codes Commodity unit prices Discounts Baud rate for electronic data transfer Manual Gross Weight Entries for application where this feature is permitted in Handbook 44

11. IZSM Test Procedures

Source: 2002 Weighing Sector Agenda Item 30

Background: This item carried was carried over from the 2002 Weighing Sector meeting due to lack of time to complete review of the subject at that meeting. See 2002 Weighing Sector Summary (2003 NTEP Committee Annual Report, Appendix F, Item 30) for complete background details.

At the 1998 Weighing Sector meeting, the NTEP laboratories agreed to adopt and implement a procedure for testing the initial zero-setting mechanism (IZSM) of a scale in the field. The procedure was modified and was to be included in the next edition of Publication 14. Such procedure was also proposed to amend Handbook 44. The item was placed on the 2002 agenda because the 1998 recommendations were never added to the publications.

Discussion/Conclusion for Changes to Handbook 44 Scales Code: The 2003 Sector agreed with the 1998 Weighing Sector proposal to amend Scales Code paragraph S.2.1.5. The 2003 Weighing Sector, however, recommended that the language for "complete scales" and "separable indicating elements" should be consistent with the language used in Scales Code Table S.6.3.a. and amended the proposal as follows:

S.2.1.5. Initial Zero-Setting Mechanism. -

(a) Scales of accuracy classes I, II, and III may be equipped with an initial zero-setting device.

(b**) Weighing, load-receiving, and indicating element in the same housing or covered on the same CC.** An initial zero-setting mechanism shall not zero a load in excess of 20 % of the maximum capacity of the scale unless tests show that the scale meets all applicable tolerances for any amount of initial load compensated by this device within the specified range.

(c) ***Indicating element not permanently attached to weighing and load-receiving elements be covered on a separate CC****. The maximum Initial Zero-Setting Mechanism range of electronic indicators must be limited to 20 % of the ~~scale capacity~~ configured capacity.*

Discussion/Conclusion for Changes to Publication 14 (2003 edition): There were no major discussions on this item or significant updates to the proposed language. The Sector recommends that the underlined language in the proposal be incorporated into NCWM Publication 14, Weighing Devices Technical Policy, Checklist, and Test Procedures.

40. Zero Indication

Code References: S.1.1., S.1.1.1., S.2.1.5, and G-S.5.1.

A digital electronic scale must indicate or record a zero-balance condition. An out-of-zero-balance indication on both sides of zero is required. The zero-balance indication may be a continuous digital-zero indication or indicated by some other means, provided the scale either automatically inhibits the scale operation or returns to a digital-weight indication when an out-of-zero-balance condition exists. The alternative zero indication must be defined on the front of the device.

A digital zero-balance indication shall represent zero within ± 0.5 scale division (± 0.5 d). A digital indicating scale shall either automatically maintain a "center-of-zero" condition to ± 0.25 d or less (through AZSM) or have a supplemental center-of-zero indicator that defines the zero-balance condition to ± 0.25 d or less. The center-of-zero requirement applies to the gross load zero, but the center-of-zero indication may also be operational at the net load zero.

Neither a + or - sign may appear with the zero indication. Appropriate indications for the zero balance and out-of-zero balance conditions are specified.

If the scale is equipped with an initial zero-setting mechanism (IZSM), then the scale must be tested for compliance with the influence factors with the maximum load zeroed through the IZSM. This is mandatory if the range of the IZSM exceeds 20 % of the scale capacity.

When the IZSM range (absolute value of the maximum load that can be removed from the dead load plus the maximum load that can be added to the dead load) exceeds 20 % of the scale capacity, performance tests are conducted at the maximum setting of the range.

The IZSM range of a complete electronic scale may exceed 20 % of the scale capacity if the device performs within tolerances.

When the IZSM range is # 20 % of the scale capacity, performance tests are conducted once at the maximum IZSM setting.

Is the scale equipped with an IZSM? **Yes ☐ No ☐ N/A ☐**

If yes, then what is the range of the IZSM? _____

40.1. The scale defines zero within ± 0.5 d by a continuous zero indication. Record the type of weight unit selection (e.g., lb/kg). **Yes ☐ No ☐ N/A ☐**

☐ EXTERNAL
☐ INTERNAL
☐ N/A

Record the actual zero width in d (note whether avoirdupois, metric, or other unit).

☐ AVOIRDUPOIS_____d
☐ METRIC_____d
☐ OTHER UNITS: Specify unit _____d

40.2 The maximum IZSM range of an indicating element (not permanently attached to weighing and load-receiving elements) and intended to be covered on a separate CC:

40.2.1 does not exceed 20 % of the scale capacity, or **Yes ☐ No ☐ N/A ☐**

40.2.2 can be set and sealed (see table of sealable parameters) to a maximum of 20 % of the scale capacity **Yes ☐ No ☐ N/A ☐**

40.3~~2~~. ***Renumber subsequent paragraphs in Section 41***

12. Weight Accumulators

Source: 2002 Weighing Sector Agenda Item 31

Background: This item was carried over from the 2002 meeting of the Weighing Sector due to lack of time to review the subject. See the 2002 Weighing Sector Summary (2003 NTEP Committee Annual Report, Appendix F, Item 31) for complete background details.

At the 1997 Weighing Sector, the proposal to address the addition of weight accumulation features was approved but never added to Publication 14.

Discussion: The Sector was asked to review the proposal from the Maryland participating laboratory to see if any corrections/updates were required.

Conclusion: There were no major discussions on this item or significant updates to the proposed language. The Sector recommends that the proposal be incorporated into NCWM Publication 14, Weighing Devices Technical Policy, Checklist, and Test Procedures.

13: Listing of Weighing Device Types

Source: 2002 Weighing Sector Agenda Item 4

Background: At the 2001 NTEP Participating Laboratories meeting, the participating labs and the NIST technical advisor were asked to create an outline of device types based upon accuracy class, special use (e.g., vehicle, livestock, etc.), and physical design. Refer to Attachment to Item 4 for a complete draft copy of the outline. See the 2002 Weighing Sector Summary (2003 NTEP Committee Report, Appendix F, Item 4) for complete background information.

Discussion: During the 2003 NTEP Participating Laboratory meeting, the labs discussed an outline format. The labs also reviewed a draft CC template with five drop-down menus that would be used to select the device type in the "For" box on the CC. The labs did not favor the use of the outline format since it did not reduce the number of device types. (Note: The labs did not address the issue of application vs. design device types because there has been no consensus of the Sector or direction from the NCWM membership and regulators.) Therefore, the labs compared the list of device types listed in the Section 2 (Weighing Devices) of Handbook 44, the device types listed on the CCs, and the database search list.

The labs believed the list of device types could be shortened to a manageable level that could be used in the draft CC template and CC search database through either the search selections or possibly a keyword search. The DRAFT template offered a selection from five fields:

Field 1 - Main Type (vehicle, bench, etc.)
Field 2 - System, Instrument (complete device), controller, or element (separable) (load cell technology in the case of load cell CCs)
Field 3 - Main feature or application (load cell design for load cell CCs)
Field 4 - Technology
Field 5 - Accuracy Class

The labs significantly shortened the list and identified device types that would be more appropriately listed as a "feature" in the "Standard Features and Options" (SFO) box in the CC. The Maryland and Ohio participating labs volunteered to continue working on the template using the device types from the shortened list as many of the remaining device types can be considered as design, technology, and features or options that could be located in the SFO box.

Additionally, Steve Patoray indicated that there are approximately 3000 existing CCs that would need to be reclassified according to any future list of device types to facilitate searching the CC database. It was suggested that the CCs be divided among the labs and the lab personnel could code or classify the CCs according to the list of "main" device types. Inactive CCs would not have to be republished but would be recoded or reclassified for the NTEP searchable database. "Active" CCs would have the CC updated to the draft CC template using the list of selections in the different fields.

The Sector was asked to review the approach suggested by the participating laboratories and provide support, comments, and/or suggestions to improve this approach. The Sector was also asked to review the two examples of the CC template fields and selection lists developed by Steve Patoray and Steve Cook and forward comments to them on the preferable CC template approach along with additions or deletions of the template field selections.

Field 1 (Main Type)	Field 2	Field 3	Field 4	SFO
Animal*	Scale	General Application	Mechanical	Automatic hopper scale hopper scale with controlling electronics
Automatic Bulk Weighing	Element	Coupled in motion	Electronic	Axle load weighing**
Automatic Weighing	System	Uncoupled in motion	Electromechanical	Livestock weighing**
Belt conveyor scale system	Load-receiving element	Automatic		Multi-interval* *
Checkweighing *	Controller	Dynamic	Single (LC CC)	Multiple range* *
Computing	Scanner Scale *	Static	Multiple (LC CC)	Postal scale**
Counter/Bench		Grain*		**Scanner Scale****
Crane	Analog (LC CC)	Weight classifier*		Self- checkout
Grain test	Digital (LC CC)	Postal scale*		Single animal weighing**
Hanging	Hydraulic (LC CC)	Multiple range		Weighbeams**
Hopper		Multi-interval		Weight classifier**
Indicator				Pre Packaging**
Livestock*		**S- Type (LC CC)**		
Load cell		**Shear Beam (LC CC)**		
Monorail		Double Ended (LC CC)		
Platform scale (other than bench/counter, vehicle, and etc.)		Canister (LC CC)		
Point-of–Sale*		(Other load cell designs)		
Portable axle load *				
Prepackaging *				
Prescription *				
Railway *				
Vehicle *				
Vehicle onboard weighing *				
Wheel load weighers*				
Others-Berry Basket Customer operated bulk weighing systems Equal arm scale				

Field 1 = Main Type (vehicle, bench, etc.)
Field 2 = System, Scale, or Instrument (complete device), or separable; controller or element (or load cell technology in the case of load cell CCs)
Field 3 = Main feature or application (or load cell design for load cell CCs)
Field 4 = Technology (see Field 2 for load cells)
Field 5 = Accuracy Class
SFO = Standard Features and Option
* If a Handbook 44 ***application***-based type device is selected, it can only be used for that application unless additional applications are listed as options in the SFO
** This type of scale is to be listed as an option if either the technology is an optional feature of a family or the scale is part of a family that can be used in for two or more Handbook 44 "Application-Based Device Types." For example, vehicles scales that have racks and gates in order to weigh livestock or single animals, a short vehicle scale that can be used to weigh axles, railroad scales that can weigh highway vehicles, and etc., must have the capability listed as an option in the SFO box.

An Alternative Approach by Steve Patoray.			
Field 1 (Main Type)	**Field 2**	**Field 3**	**SFO/Application**
Automatic Bulk Weighing	Scale	Electronic	**Animal**
Automatic Weighing	**Element**	Electromechanical	Axle load weighing
Belt conveyor Scale	**System**	**Mechanical**	**Checkweighing**
Computing			Counter/Bench
Crane	Analog (LC CC)	Coupled in motion	Grain
Grain test	Digital (LC CC)	Uncoupled in motion	Livestock
Hanging	Hydraulic (LC CC)		Platform
Hopper		Controller	Portable
Indicating			Portable axle load
Load cell		Dynamic	Postal scale
Monorail		Static	Pre Packaging
Non-Computing			Prescription
Point-of–Sale		Multiple range	**Railway**
Vehicle onboard weighing		Multi-interval	Scanner Scale
Weighing/Load Receiving			Self- checkout
		Compression (LC CC)	Vehicle
		Tension- Type (LC CC)	Weighbeams
		Shear Beam (LC CC)	Weight classifier
		Bending Beam (LC CC)	Wheel load weighers
		Double Ended (LC CC)	
Others- Berry Basket Equal arm scale			

Conclusion: The Sector supports the concept of listing a limited number of device types on Certificate of Conformance template and preferred the list of device types in the table suggested by the NTEP director since it has fewer device types. Additionally, the Sector encourages the NTEP Committee and the NCWM Board of Directors to incorporate a "keyword" search engine in the Certificate of Conformance database.

New Items

14. Recommended Changes to Publication 14 based on Actions at the 2003 NCWM Annual Meeting

Background: The NTEP technical advisor has typically attempted to provide the Sector with specific recommendations for incorporating test procedures and checklist language based upon actions of the previous Annual Meeting of the NCWM. Due to the close proximity of the Annual Meeting and the Sector Meeting, there has not been sufficient time for the NIST technical advisor to develop and vet recommended language for Publication 14 for all items adopted by the NCWM. The Sector was asked to discuss each item and provide general input on the technical aspects of the issues.

Discussion/Conclusion: The Sector chairman discussed alternatives to developing proposed language for recommended changes to Publication 14 during the Sector meeting.

The Sector considered and agreed with the following approaches for developing specific proposed language:

1. The NTEP director, technical advisor, and/or Sector chairman might develop changes to Publication 14 jointly.
2. Additionally, the Sector chairman can appoint small work groups to work with the technical advisor to develop recommended language.

For either alternative, the Sector would then be balloted for approval of the proposed language prior to the NCWM Interim Meeting.

14a. G-S.1. Identification and G-S.1.1. Not-Built-for-Purpose Devices, Software-Based; Software-Based Devices

Background: During its 2003 Annual Meeting, the NCWM agreed to modify Handbook 44 paragraphs G-S.1. and G-S.1.1. The approved language will be incorporated into the 2004 Edition of NIST Handbook 44. See the 2003 S&T Committee Annual Report Item 310-1 for language adopted by the NCWM at that meeting.

Discussion: The Sector reviewed the new language for Handbook 44 and Publication 14 DES Section 3. Marking – Software. The Sector discussed the possibility of a small work group to amend Publication 14, Section 3 and recommended that the language be kept brief and straightforward. The NTEP director stated that all sections of Publication 14 are affected by the new language in Handbook 44 and suggested the work group limit the review to digital electronic scales for completion by November 2003. The NIST technical advisor to the Weighing Sector was asked to incorporate the language, as appropriate, into the checklists for the following devices:

ABWS Section 17. Marking – General, BCS Section 8 Marking Requirements,
ECRS Section 5. Identification,
AWS Section 1. General Code Requirements, Identification, and
MDMD Section 1. Marking – Complete Devices (and main elements).

Conclusion: The Ohio and Maryland participating laboratories and Bob Hamilton (Mettler-Toledo) volunteered to develop language that can be recommended for incorporation into Publication 14. The NIST technical advisor will ballot the Sector members for their approval.

14b. Counting Feature on Class I or II Scales Used in Prescription-Filling Applications.

Background: During its 2003 Annual Meeting, the NCWM agreed to modify paragraph S.1.2.3. of NIST Handbook 44. The approved language will be incorporated in the 2004 Edition of NIST Handbook 44. See the 2003 S&T Committee Annual Report Item 320-2 for language adopted by the NCWM at that meeting.

Discussion: The Sector reviewed the language adopted by the 88th NCWM at their annual meeting and discussed a draft checklist developed by Brian Christopher (McKesson) that was distributed to the Sector. The Sector discussed the need to verify that minimum piece weight and piece count limits required by the new language in Handbook 44 are effective. Additionally, NTEP tests should be conducted with counts and load that are less than the minimums in new paragraph S.1.2.3. that verify the scale is prevented from displaying a total piece count (e.g., 29 e and/or 9 pieces for samples to determine piece weights). There was also a discussion that the scale cannot be recalibrated while evaluating the counting feature. The manufacturers explained that it is possible to have inaccurate weight measurements and still have correct count indications. Additionally, the recommended checklist should include verification of new marking requirements.

Conclusion: The Sector recommends that the Publication 14 evaluation checklist submitted by Brian Christopher be further developed with the assistance of the participating laboratories, the NTEP director, and the NIST technical advisor. Since applicants are waiting for the new requirements in Handbook 44 to become effective, the Sector recommends that the checklist be used on an ***ad hoc*** basis until the procedure can be fully evaluated and accepted by the Sector.

14c. Section and Shift Test Procedures for Livestock Scales.

Background: During its 2003 Annual Meeting, the NCWM agreed to modify Section N.1.3.4. of NIST Handbook 44. The approved language will be incorporated in the 2004 Edition of NIST Handbook 44. See the 2003 S&T Committee Annual Report Item 320-2 for language adopted by the NCWM at that meeting.

Discussion/Conclusion: The Sector reviewed the language adopted by the 88th NCWM at their Annual Meeting and Publication 14 Section DES 64. The Sector reviewed and recommended the following proposal submitted by Don Onwiler (NE) to amend Publication 14.

64.1.2. Performance Tests for Livestock Scales with More than 2 Sections:

At least two complete sets of shift tests shall be conducted over each ~~section~~ main load support. This is to determine the repeatability of the scale. ~~Each set must include determination of error~~ Record increasing/decreasing load indications as you add weights to or remove weights from the platform at a minimum of five intervals of test loads up to, but not exceeding, ~~90~~ 50 % of the section capacity repeated over each ~~section~~ main load support. For the first set, perform this test on each ~~section~~ main load support, unloading the weights and checking zero balance before going on to the next ~~section~~ main load support. For the second set, complete the increasing load build-up on one ~~section~~ main load support and move the weights to the next ~~section~~ main load support without unloading the scale. If a scale consists of modules connected together to comprise the weighbridge, conduct shift tests by placing the load to the left, right and center of the connection between the modules. Take several readings as the weights are being removed. When all the weights have been removed, record the return to zero. The scale must return to zero within one-half of a scale division. ~~When analyzing the return to zero, consider the length of time the load was on the scale and for possible temperature changes that may have occurred during the test. Determine scale errors at more points if desired. Avoid decreasing load tests when testing a section.~~ Next, conduct an increasing load test to the scale nominal capacity ~~or at least to the used capacity~~ by distributing the test load over the platform in at least five intervals and record the error for each interval. Be careful not to exceed the SECTION CAPACITY of a section when loading the weights and distributing loads across the section. Record decreasing load indications as you remove weights from the platform in at least five intervals. The scale must return to zero within one-half of a scale division.

~~Conduct decreasing load tests after the sections have been tested to their maximum load and the weights are from the scale.~~

NOTE: *Decreasing-load tests only apply to automatic indicating devices.*

~~64.1.3. At least one complete set of shift tests to at least 90 % of the section capacity shall be conducted at mid span between sections.~~

~~64.1.4. If a scale consists of modules that are connected together to comprise the weighbridge, conduct shift tests by placing the load so that it straddles the connection between the modules. Later, conduct at least one shift test on the scale with the test load placed first on one side of the connection line of the module, then on the other side of the connection line.~~

64.1.~~5~~3. The results of shift tests must agree within the absolute value of the applicable maintenance tolerances and must be within acceptance tolerances.

14d. Power Supply, Voltage and Frequency

Background: During its 2003 Annual Meeting, the NCWM agreed to the following amended language for the 2004 Edition of NIST Handbook 44:

T.N.8.3.1. Power Supply, Voltage and Frequency.

(a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive, from -15 % to +10 % of the marked nominal line voltage(s) at 60 Hz or the voltage range marked by the manufacturer at 60 Hz (range takes precedence).

The NIST technical advisor modified language from OIML R76-1 for Non-Automatic Weighing Instruments and the OIML R76-2 test form for voltage tests to amend existing Publication 14 voltage power supply language and tests in Section 60.7. Test.

Discussion: The Sector reviewed the proposed amendments to Publication 14 and the new test form. The proposed procedure requires the evaluator to conduct increasing and decreasing load tests. The earlier procedure only tested the

device under test at one test load. The additional performance test more closely aligns the tests and report form with OIML R76. Some participating laboratories indicated that the additional test should be conducted. The manufacturers stated that the additional tests are unnecessary and suggested that the labs perform both tests over the next year and report the difference in test results at the 2004 meeting of the Weighing Sector. If there are no differences, the information could be submitted to the Secretariats for the revision of R76 to justify amending the international procedures and test forms.

Manufacturers recommended deletion of the language that the test shall be performed at V_{min} -15 % and V_{max} +10 %. The justification is that the range marked on the device includes the most common range of nominal voltages in addition to the V_{min} -15 % and V_{max} +10 %. One manufacturer stated that is it only necessary to test the device at -15 % +10 % of $V_{nominal}$, or in case a range is marked on the scale, V_{min}, V_{max}, and $V_{nominal}$.

Conclusion: The Sector agreed with the recommendation to perform voltage variation tests at -15 % and +10 % of $V_{nominal}$, or in case a range is marked on the scale, V_{min}, V_{max}, and $V_{nominal}$. The laboratories agreed to perform type evaluation tests for voltage variations at a single test load and during an increasing/decreasing load test and report the results to the technical advisor prior to the next meeting of the Sector.

The Sector further recommends that the following be included in Publication 14:

60. Power Voltage Variations

Code References: T.N.8.1.3.

The power supply is varied to determine the performance and operating characteristics of the equipment under test at different voltage levels required by T.N.8.3.1. ~~found in the field under normal operating conditions.~~

Note: Where an instrument is powered by a three-phase supply, the voltage variations shall apply for each phase successively.

If the instrument is provided with an automatic zero-tracking device, it may be in operation during the test, in which case the error at zero point shall be determined by determining the error at a test load several intervals above the zero tracking limits.

(Delete paragraph 60.3.4.)

~~60.3.4. AZSM operable if so equipped and appropriate for the intended use.~~

13. VARIATION OF VOLTAGE
(T.N.8.3.1. DES Section 53.3)

Control No.: _____
Pattern designation: _____

Date: _____
.....
Observer: _____
Verification scale interval e: _____

	At start	At max	At end
Temp °C:			
Rel. h %:			
Time:			
Bar. Pres (hPa):			

(Class I Only)

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☐ Out of working range ☐ In operation

Marked nominal voltage or voltage range AC or DC (from main): _____
Marked nominal DC voltage battery operated instruments: _____ ……

E = I + 1/2 e -) L - L
$E_c = E - E_0$ with E_0 = error calculated at or near zero (*)

Voltage (**)	U (V)	Load L		Indication I	Add. Load) L	Error E	Corrected error E_c	mpe
Reference value		10 e						
		½ max						
		max						
Reference value – 15 % (or lower limit of battery voltage)		10 e						
		½ max						
		max						
Reference value + 10 % (or upper limit of battery voltage)		10 e						
		½ max						
		max						
Reference value		10 e						
		½ max						
		max						

** In case a voltage range (V_{min}, V_{max}) is marked, then the test shall be performed at $V_{min,}$ V_{max} and at the nominal line voltage of the laboratory.

☐ Passed ☐ Failed

Remarks: _____

14e. Concentrated Load Capacity - Definition.

Background: During its 2003 Annual Meeting, the NCWM adopted the following language for the 2004 Edition of NIST Handbook 44:

concentrated load capacity (CLC) (also referred to as Dual-Tandem Axle Capacity (DTAC). A capacity rating of a vehicle or axle-load scale specified by the manufacturer, defining the maximum load applied by a group of two axles with a centerline spaced 4 feet apart and an axle width of 8 feet for which the weighbridge is designed. The concentrated load capacity rating is for both test and use.[2.20]

Discussion/Conclusion: The Sector compared the definition of "CLC" as adopted by the 88th NCWM at its Annual Meeting to that in Publication 14 Section DES 65 – Vehicle Scales. The Sector recommends no further action on this item since changes in the definition of CLC in Handbook 44 do not affect the test procedures in Publication 14.

14f. Substitution and Strain Load Definitions, Test Notes and Tolerances.

Background: During its 2003 Annual Meeting, the NCWM adopted the following language for the 2004 Edition of NIST Handbook 44:

T.7. Tolerances for Strain-Load Test. - The tolerances apply only to the test weights or substitution test load.

substitution test. A scale testing process used to quantify the weight of material or objects for use as a known test load.

substitution test load. The sum of the combination of field standard test weights and any other applied load used in the conduct of a test using substitution test methods.

Discussion and Recommendation: The Sector compared the new definitions for "substitution test" and "substitution test load" as adopted by the 88th NCWM at its Annual Meeting and to those in Publication 14 Section DES 65 – Vehicle Scales, 68 – Railroad Track Scales, and 71 – Hopper Scales. In 1997 Richard Suiter (NIST) developed substitution test procedures for hopper scales that were incorporated into the 1998 Edition of Publication 14. Gary Castro (CA) agreed to modify those procedures to produce a generic procedure suitable for use on all scales. The Sector reviewed and approved the following addition for inclusion in Publication 14:

Add new Publication 14 Section 74 and refer existing references in Sections 64.3, 65a, 65b, and 65c to this section.

74 Guidelines for Substitution Test Procedures (Locate along with guideline documents at end of Pub 14 DES)

Code References: N.1.11., and N.1.12.

In the substitution test process, material or objects are substituted for known test weights, or a combination of known test weights, and previously quantified material or objects, using the scale under test as a comparator. Additional test weights or other known test loads may be added to the known test load to evaluate higher weight ranges on the scale.

Tolerances are applied to the scale based on the substitution test load.

Sections 74.1. through 74.2.14 of Publication 14 remain unchanged.

15. Policy on Converting CLC on Section Capacity for Active Livestock Scale CCs.

Source: NIST WMD

Background: NIST became aware that a livestock scale manufacturer and Montana Weights and Measures identified a problem in Handbook 44 paragraph S.6.5 for 2-section livestock scales with CLCs greater than 1/2 times the nominal capacity. Prior to defining CLC, there was no Handbook 44 relationship of the rated section capacity to the nominal capacity. The section capacity requirement added to Handbook 44 in 2002 now has a relationship with the nominal capacity, depending on the number of sections. When CLC requirements were added to Handbook 44 in 1989, the NTETC Weighing Sector established a policy that allowed existing section capacities be reclassified with CLCs determined by the manufacturer. See the January 1989 Sector Summary in the 1990 NTEP Committee Annual Report for complete background information.

Discussion: The Sector discussed language to establish a technical policy for livestock scale CCs issued between 1999 and 2003. One manufacturer stated that the company increased its nominal capacities when their CCs were amended to change section capacity ratings to CLC ratings and that their nominal capacities should be lowered to comply with the

new requirements. Not all livestock scale CC holders requested this increase in nominal capacity. A Sector member noted evaluations conducted during this period complied with all Handbook 44 requirements at the time of the evaluation, and forcing these companies to reduce the nominal capacity or resubmit the device for reevaluation is unreasonable.

The Sector reviewed and discussed a proposal from the State of Montana that would remove the apparent "design criteria" in the recently adopted language in Handbook 44 paragraph S.6.5. It was also reported that the Central Weights and Measures Association Specifications and Tolerances (S&T) Committee forwarded this proposal to the NCWM S&T Committee. The Nebraska and Oregon participating laboratories supported the Montana proposal since it removes "design criteria" from Handbook 44 and would not penalize manufacturers that have complied with earlier type evaluation requirements. One manufacturer stated that the proposal would permit under-engineered scales and possibly make manufacturers liable in the event of damage should a scale collapse under concentrated loads. Other manufacturers made no additional comments in support of or opposition to this statement.

Conclusion: The Sector did not reach consensus on a technical policy for livestock scale CCs with CLC ratings. Additionally, the Sector did not develop a position on Montana's proposal to the NCWM S&T Committee.

16. Not-Built-For-Purpose (Software) System Evaluations.

Source: Maryland NTEP Laboratory

Background: The NTEP labs receive a large number of assignments for software-based systems. The laboratories have been informed to evaluate these systems using the requirements for hardware-specific devices, but it is a difficult task to do. Not-built-for-purpose software, i.e., software installed on an off-the-shelf personal computer (PC), appears to provide the end user with greater access to change metrologically significant parameters than the software placed on an EPROM within a hardware-specific device.

In 1998 the NCWM voted that NTEP would not evaluate and issue NTEP certificates for software. Evaluations would be conducted on complete systems and would receive device or system NTEP certificates. The NTEP laboratories and the manufacturers were not given any documented guidance on how to address the following issues on the complete software-based systems:

-What hardware/software could be substituted in the system and what is the basis for determining the compatibility?
-What must be listed on the Certificate if verification of the software used in the system is necessary (operating system, memory size, processor speed)?

The thoroughness of all evaluations relates directly to the evaluator's experience as a field inspector and knowledge of PCs, programming languages and basic scale designs. Without clear guidelines and proper training in software, the NTEP laboratories may not apply the appropriate requirements uniformly.

The last Software Work Group was assigned the task of developing guidelines. This task was never completed. All laboratories should utilize the interim policy described in the October 8, 1997, NTEP memo. Alternatively the labs could develop a supplemental checklist for the evaluation of software.

The interim policy has not been updated or replaced and is not being consistently applied among the NTEP labs. Software-generated primary weight displays are not consistently checked for compatibility with various combinations of hardware interfaced to the software.

At their 2003 meeting, the weighing devices participating laboratories recommended that the NTETC Weighing Sector and NTEP Committee consider incorporating an updated version of the interim policy (October 8, 1997) into Publication 14, "Administration Policy Section C, Devices to be Submitted," or Publication 14 Technical Policy for Scales.

The labs agreed that an evaluation of a software-based system does not need to include a field evaluation if it can be demonstrated that the system complies with Publication 14 procedures when interfaced with weighing-elements or load-cell simulators, indicator(s), recording elements and representative computer hardware and operating systems. The evaluation can take place at the NTEP laboratory, manufacturer's facility, a field test site, or a combination of locations.

Additionally, some of the labs requested clarification about the interim policy listing compatible hardware and whether the list was applicable to combinations of weighing and measuring device elements or not-built-for-purpose hardware such as computer monitors, microprocessors, and computer operating systems. NIST confirmed the statement **"that compatibility list will be included on the Certificate of Conformance"** was intended to apply to the computer (PC compatible, Mac, or other) using the application software. It was not intended that the CC list compatible weighing, measuring, indicating, and recording elements.

Discussion: Since this item was inadvertently not discussed during the 2003 Weighing Sector meeting, the NIST technical advisor balloted the Sector on the following policy for software-based not-built-for-purpose devices and accessories to weighing systems and asked the Sector to consider a recommendation to add the following policy to Publication 14 NTEP Technical Policy for Scales Section A. Models to be Submitted for Evaluation.

> **Software-based, not-built-for-purpose devices.** Software-based not-built-for-purpose weighing equipment or accessories used in conjunction with weighing equipment or systems submitted for evaluation must be evaluated with a complete weighing system and will be evaluated using the same Publication 14 criteria applicable to built-for-purpose weighing equipment or accessories. The applicant will provide the NTEP participating laboratory a representative weighing system including indicating, printing, and load-receiving elements (or load-cell simulators) along with representative not-built-for-purpose hardware such as a computer running the application software, keyboard, and computer display (the applicant's software will not be installed in computers used by the NTEP laboratories). The evaluation will include all potential use applications (weigh-in/out, livestock, postal/parcel shipping, automatic bulk weighing, etc.) identified on the NTEP application. The evaluated use applications will be listed on the Certificate of Conformance.
>
> Typically, the entire evaluation can be accomplished at the NTEP participating laboratory or at a manufacturer's or applicant's facility. It is up to the applicant and the assigned laboratory to conduct the evaluation at the participating laboratory, manufacturer's facility, field test site, or a combination of test sites where data can be collected and evaluated to complete the evaluation.
>
> The NTEP application must specify the minimum operating requirements for which software used in the system is designed to be compatible, and that list will be included on the Certificate of Conformance. For example, the CC may state, "The software used in not-built-for-purpose weighing devices or used in connection with weighing devices or systems must be used with any generic, IBM-compatible (or MAC) computer, with a XXX or higher operating system, 4XX or higher processor."

The results of the vote were as follows:

> 9 – Affirmative (3 labs, 5 manufacturers, and 1 manufacturer with comments)
> 1 – Opposed with comments (lab)
> 4 – Abstained (3 were not present at the meeting)

Conclusion: The Sector recommends the following technical policy, as edited by the NIST technical advisor, based upon comments received in the responses to the ballot, for software-based not-built-for-purpose devices be added to Publication 14 NTEP Technical Policy for Scales Section A. Models to be Submitted for Evaluation.

> Software-based, not-built-for-purpose devices. Software-based, not-built-for-purpose weighing equipment or accessories used in conjunction with weighing equipment or systems submitted for evaluation must be evaluated with a complete weighing system and will be evaluated using the same Publication 14 criteria applicable to built-for-purpose weighing equipment or accessories.
>
> The applicant will provide the NTEP participating laboratory with a complete and representative weighing system, and shall include the hardware necessary for the normal metrological operation and NTEP evaluation of the device.
>
> The following is a list of hardware that may be necessary to complete the NTEP evaluation. The applicant and assigned laboratory should agree on additional pieces of hardware necessary for the normal metrological operation and NTEP evaluation of the system.

Complete scale(s) or Separable (Primary) Indicating Element with a Load-receiving element(s) and/or load-cell simulator(s); and

Printing/recording element	Mouse
Minimum computer technology and memory to be covered on the CC	Operator keyboard
Application and associated software	Monitor
Type and minimum Operating System (OS) to be covered on the CC	

The applicant's software will not be installed in computers used by the NTEP laboratories. The evaluation will include all use applications (weigh-in/out, livestock, postal/parcel shipping, automatic bulk weighing, etc.) identified on the NTEP application. Only the evaluated use applications will be listed on the Certificate of Conformance.

The entire evaluation can be accomplished at the NTEP participating laboratory or at a manufacturer's or applicant's facility. The applicant and the assigned laboratory shall agree where to conduct the evaluation, either at the participating laboratory, manufacturer's facility, field test site, or a combination of test sites where data can be collected and evaluated to complete the evaluation.

The NTEP application shall specify the minimum operating requirements for which software used in the system is designed to be compatible. That list will be included on the Certificate of Conformance. For example, the CC may state, "The software used in not-built-for-purpose weighing devices or used in connection with weighing devices or systems must be used with any generic IBM-compatible (or MAC) computer, with an XXX (ex: DOS X.X, Windows XX.X, IBM PS2, MAC OS X.X, and etc.) or higher operating system, and an XX or higher processor ."

The CC must include the following information:

- Application(s) (ex. POS, livestock, parcel, automatic bulk-weighing, and etc.)
- Manufacturer or applicant of the software-based, not-built-for-purpose device
- Application software model(s) evaluated
- Application software version XXXXX evaluated and higher
- (MAC, PC or XXX) compatible "software-based, not-built-for-purpose device (hardware)"
- (DOS X.X, MAC OS X.X, Windows XX, IBM PS2, or . . .) or higher operating system
- XXX or higher microprocessor with a speed of XXX or higher
- Additional hardware necessary for the normal "metrological" operation of the device (e.g. UPS, PLC controller, and etc.
- A statement such as "The ***software-based, not-built-for-purpose device or system*** may be interfaced with compatible weighing equipment that has a CC (ex. complete scale(s) or separable indicating and load-receiving elements)."

17. Section E. Modification of Type – Replacing Lever Systems with Load Cells.

Source: NTEP Participating Laboratories

Background: (See the 1999 NCWM NTEP Committee Report, Appendix J, Item 29 for complete background information.)

This subject was addressed at the November 1998 meeting of the NTETC Weighing Sector, and, at that time, the "Sector agreed that replacing **any** levers of a mechanical weighing element with load cells is a modification of type requiring NTEP evaluation . . .." Part 1 states, "Total replacement of any levers . . ." is a modification of type. Publication 14, Section E, Part 1, however, is unclear with respect to the replacement of levers with load cells.

As an example: the transverse lever and main levers have been removed on a three-section scale. All support levers are still in place, but there are now three load cells. Is this type modification ***acceptable*** without **a**dditional NTEP evaluation? The Sector is asked to consider the following proposal. If the modification ***is not acceptable,*** Section E should be amended to clarify the use of the words "**total**" and "**any**" since they may be considered conflicting terms or may be responsible for inconsistent application of this technical policy.

Additionally, part 2 of Section E requires that the modification option for placing a load cell in the steelyard rod be listed on the CC. The NTEP laboratories question if this policy is necessary. While this is not a broad-based problem, NTEP should be specific on the regarding the various types of levers that can or cannot be replaced without additional NTEP evaluation.

Discussion: At the 2003 participating laboratory meeting, the labs supported the change that the placement of a load cell in the steelyard rod does not have to be listed on the Certificate of Conformance. Field inspectors are not aware of this NTEP requirement, and this type of option or feature has not consistently been listed on CCs. There was also discussion about whether or not the replacement of different types (functions) of levers or partial replacement of levers with load cells should be allowed without additional NTEP evaluation. The labs were concerned that individual states might apply different policies without a specific NTEP policy.

The Kansas lab related its experiences with lever replacement as a service agent and presented the following justifications that the partial replacement of levers should be considered a modification of type that requires additional NTEP evaluation.

1. Center extension levers are typically replaced if the entire scale has deteriorated and should be replaced.
2. Main levers (sections) ratios and lever multiples change with mechanical adjustments. This would be a problem with selecting the proper load cell depending upon which lever the load cell was replacing. There are compatibility problems unless mechanic knows what he is doing.
3. Independent power supplies may be required which affect the load cell sensitivity to influence factors.
4. There are too many combinations of lever types and load cells to make a "one size" fits all policy regarding partial lever replacement.
5. The different mechanical (multiple) ratios and the amount of lever movement or travel have an impact on compatibility that requires a well-trained service agent.

While the participating laboratories agreed the placement of a load cell in the steelyard rod does not have to be listed on the CC, they believe that any replacement or modification of any lever (knife/bearing size, material, etc.) is considered a modification of type that should be evaluated and listed on the CC.

Conclusion: There was general support to amend Section E as recommended by the NTEP participating laboratories. A scale manufacturer asked if the recommended policy would apply to replacing the levers on mechanical scales and replacing them with load cells if the mechanical scales had an identical weighbridge and a full electronic scale. The response from the Sector indicated that the policy *would not apply if* the original manufacturer or its authorized representative modified the mechanical scales consistent with a full electronic scale with the same weighbridge design. The proposed policy would apply if the original manufacturer were not involved with the modification or the weighbridges were not identical. Further, the NTEP technical policy on retrofitting scales would apply if a manufacturer performed this modification to another manufacturer's scale and relabeled it as its own. Additionally, the Sector considered cutting levers and removing parts of a lever system (e.g., pipe lever) as a modification to the type that would require additional NTEP evaluation to be covered on an NTEP CC.

Recommendation: The Sector recommends the following amendments to Publication 14 Section E. Modification of Type – Replacing Lever Systems with Load Cells and Conversion of Mechanical Scale to Electro-Mechanical:

E. Modification of Type

Note: *Drawings should be submitted for all applications for a modification of type (except paragraph 2). Any NTEP application for a modification of type must be a completed NTEP Scales Application. (not an NTEP non-technical, editorial change application)*

1. **Replacing a Lever System with Load Cells**. ~~Changing a scale from a lever system scale to a full electronic scale, is considered a modification of type. Total~~ Replacement or modification of any levers in a mechanical scale for the purpose of installing load cells is a modification of type that is not covered by the original CC ~~without additional testing~~.

2. **Conversion of Mechanical Scale to Electro-Mechanical.** The placement of a load cell in the steelyard rod to change from a mechanical to an electronic indicator is an acceptable modification of type that does not require evaluation for an existing CC to apply~~; however, the modification option must be listed on the NTEP CC~~.

(There are no recommendations to amend the remaining paragraphs in Section E.)

18. Physical Security Seals on Scales with External Calibration Capability.

Source: NTEP Participating Laboratories

Background: At the 2003 NTEP Participating Laboratory Meeting, the participating labs reported they have come across examples where a device could be sealed with a physical security seal while the device had been configured with access to external means to change calibration and configuration parameters. The labs have been using Handbook 44 General Code paragraph G-S.2. Facilitation of Fraud to require the applicant to correct this problem.

One laboratory reported that it had to accept this because the applicant stated that "if the operator had followed the operating instructions, this would not happen." Furthermore, the applicant cited Handbook 44 General Code paragraph G-UR.3.1 Method of Operation that states:

> **G-UR.3.1 Method of Operation.** - Equipment shall be operated in the manner that is obviously indicated by its construction or that is indicated by instructions on the equipment.

It was pointed out that Handbook 44 General Code paragraph G-S.8. Provision for Sealing Adjustable Components. and Scale Code paragraph S.1.11. Provision for Sealing. state that provisions shall be made for applying a security seal in a manner that requires **the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device**. The participating laboratories believe that external access to the calibration or configuration parameters without breaking a security seal or advancing the event counters does not comply with Handbook 44 regardless of the operator instruction manuals.

Some labs stated that there should be something in Publication 14 that tells the evaluator to look for ways to access the calibration or configuration parameters without breaking a security seal or advancing the event counters. Alternatively, Handbook 44 could be amended to make it clear that the device provide an indication that it is in the calibration mode.

This was considered an appropriate subject for the joint LMD and Weighing Sectors discussion since it involves all devices.

It was also noted that Publication 14, Section 10.10 - Category 1 Devices does not go into detail regarding compliance with Handbook 44 references. Existing language only asks if the device is sealable with a physical seal (Y/N/NA) or equipped with two event counters. Publication 14 does not ask the evaluator to verify if the physical seal is effective (reference G.S.8. and S.1.11.a.).

The NTEP weighing laboratories recommended a proposal be developed and submitted to the NCWM S&T Committee to amend the language for Category 1 devices to require a device to clearly indicate it is in the calibration mode and record such message if capable of printing in this mode (similar to the requirement for Category 2 devices). The language should be consistent with the language used for Category 2 devices. Additionally, the laboratories developed language changing the "notes" on physical seals into a checklist format and suggested additional language requiring the physical seal be "effective." The laboratories further recommended the Sector review and recommended the checklist language be added to Publication 14, paragraphs 10.10 to assure NTEP evaluators physical seals are verifiably effective.

Discussion: The Weighing Sector discussed the amendments to Publication 14 recommended by the participating laboratories. The manufacturers present were concerned the term "effective" in proposed paragraph 10.14 is vague and should be more definitive. There was also discussion that the new language in proposed paragraph 10.14 be effective one year after its incorporation into Publication 14. There was also a suggestion to amend Handbook 44 Method of Sealing for Category 1 weighing devices to require the device to clearly indicate when it is in the "set-up mode." It was reported

that there was a commitment from Will Wotthlie (Maryland Measuring Sector laboratory) to submit a proposal to the Southern Weights and Measures Association at its 2003 annual meeting.

Conclusion: The Sector supports the interpretation of Handbook 44 General Code paragraphs G-S.2 Facilitation of Fraud, G-S.8. Provision for Sealing Adjustable Components, and Scale Code paragraph S.1.11. Provision for Sealing that provisions shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device regardless of instructions provided in the instruction/service manual for the device. The Sector further agreed to support the concept of the proposal to amend Handbook 44 Category 1 Method of Sealing to require a device clearly indicate that it is in the set-up mode.

The Sector also recommended the following amendments to Publication 14, section 10. The language proposed by the laboratories and amended by the Sector was given a 2005 effective date to allow NTEP applicants not in attendance sufficient time to comply with the new checklist requirements.

Physical Seals – General (***Note:*** *Single underlined text was copied from the "Notes on Physical Seals."Double underlined text is language recommended by the weighing laboratories.* ***Bold single underlined and italics text*** *represents language added to the laboratory proposed language by the Sector.*)

10.11	The provision for sealing must be located such that a security seal can be applied without disassembly that exposes electronics. Any disassembly must be simple and not require excessive effort; for example, removing a protective cover plate to seal a junction box is acceptable. In general, it is desirable to be able to seal a device without the need for disassembly.	**Yes ☐ No ☐ N/A ☐**
10.12	A scale shall be sealed in a manner that prevents disassembly of the device by removing a cover or cabinet to gain access to the adjustments.	**Yes ☐ No ☐ N/A ☐**
10.13	The bottom of a device is an acceptable location for a security seal only if the scale is designed so that it is not damaged when turned on its side or upside down to remove and apply security seals.	**Yes ☐ No ☐ N/A ☐**
~~10.14~~	~~The physical (wire and lock or self-destructive pressure sensitive) security seal shall be effective to prevent external access to calibration means without breaking or damaging the security seal.~~	**~~Yes ☐ No ☐ N/A ☐~~**
10.14	***Access to the sealable parameters is prevented without destroying the physical seal (for devices that incorporate a physical seal to protect adjustments of sealable parameters) (Effective January 1, 2005).***	***Yes ☐ No ☐ N/A ☐***
10.15	When two bolts are used for a lock and wire security seal, the bolts must be such that the lock and wire security seal will be broken when an attempt is made to unscrew the bolts. The use of a "free-standing bolt" to serve as a second screw for threading a lock and wire security seal is not acceptable. A "free-standing bolt" is one that simply passes through a panel and is held in place by a nut on the opposite side of the panel but is not holding any parts together. Because the free-standing screw may be loosened to the extent that the bolt will rotate in its position, this permits the other bolt to be turned and the wire of the seal maneuvered over the top of the bolt while turning the free-standing bolt to keep the wire from twisting. In this case, the security seal can be removed to gain access to the adjustments without breaking the seal.	**Yes ☐ No ☐ N/A ☐**
10.16	In lieu of the second fixed bolt, a metal tab fixed to the case or a plastic tab molded into the case may be used. The fixed nature of the tab usually causes in the wire to twist and break before the bolt can be removed.	**Yes ☐ No ☐ N/A ☐**
10.17	If the lock and wire security seal is located under the platform of a scale, then there must be ample clearance to eliminate the possibility of interference between the seal and the platform.	**Yes ☐ No ☐ N/A ☐**

10.18 An indicating element that uses a NEMA 4 enclosure shall be sealed in a manner that prevents the seal from being circumvented. This may be achieved by threading a lock and wire security seal through the head of the bolt through one of the hinges and the lip of the cover of the indicator. It is not sufficient for a lock and wire security seal to be threaded through the head of the bolt and the opening in the hinge because it can be circumvented by loosening the screw slightly and pressing down on the cover to compress the sealing material and slipping the hinge off the cover. **Yes ☐ No ☐ N/A ☐**

10.19 The scale must clearly indicate it is in the set-up (calibration or configuration) mode, such as indicators, error message, or other means of indication that cannot be interpreted as legal weight values (Effective January 1, 2005). ***Yes ☐ No ☐ N/A ☐***

Renumber remaining paragraphs and delete the "Notes on Physical Seals."

19. Screen Savers on Electronic Cash Registers and Point-of-Sale Systems.

Source: Mettler Toledo

Background: **See Item 11 of the 2002 Weighing Sector Meeting Summary (Screen Savers on Electronic Cash Registers and Point-of-Sale Systems) for additional background information.**

During the 2002 Sector meeting, a vote was taken to decide if labeling is required on a weighing device (scale), independent of an ECR, that defines the "other than continuous zero indication" when the scale uses a scrolling message to indicate gross zero. The vote was in favor of adding the labeling requirement and the additional wording was subsequently added to Publication 14 2003 Edition in the Digital Electronic Scales section and associated checklist.

Mettler Toledo recommended the labeling requirement in Publication 14 2003 Edition be deleted, claiming that Handbook 44 Scales Code paragraph S.1.1.c. Zero Indication. permits a zero-balance indication "by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a weighing operation or return to a continuous digital indication when the scale is in an out-of-balance condition." There is no labeling requirement in the Scales Code section of Handbook 44.

Mettler Toledo also maintains there is no risk to the consumer if the approved device meets the performance requirements of Publication 14, 2002 Edition, Section 11.12. Specifically, it should be considered acceptable if the device automatically displays weight values when the device goes into an out-of-balance condition. A device that is properly designed by the manufacturer and properly evaluated during the type evaluation process will inherently provide protection to the consumer.

Further, Mettler Toledo claimed the labeling requirement adds cost to the device manufacturer but adds no benefit to the consumer. As a manufacturer, Mettler Toledo opposed additional labeling requirements since the goal is to meet the requirements by design, not by adding labels.

Mettler Toledo proposed the wording in Publication 14:2003 be changed as follows:

1. Section 11.8.4: delete the fifth paragraph, including the reference to G-S.6. Reference to G-S.6 is not appropriate since "the specific code requirements supercede General Code requirements in all cases of conflict" per G-A.2.

2. Section 11.8.4, box #4

- ❑ Activation of the sleep or battery/power save mode only turns off the primary weight display or the primary weight display is replaced by scrolling messages or dashes. ~~The method of indicating a zero-balance condition must be clearly defined as the zero indication as required by General Code paragraph G.S.6 Marking Operational Controls, Indications, and Features. The legend must state, "Scrolling messages indicate scale is at zero" or similar statement.~~

3. Section 11.8.4.2.
~~If the primary weight display disappears in the screen saver/sleep mode with the scale at zero and the power to the scale is not automatically shut off, the display must comply with (a) or (b) below:~~

~~(a) The zero indication or zero annunciator must be displayed, or defined if zero is indicated by other than a digital zero indication or annunciator. Yes □ No □ N/A □~~

~~If a legend is used to define zero, it must be included adjacent to the display to indicate that the information (dashes, scrolling messages, and etc.) indicate the scale is on zero. Yes □ No □ N/A □~~

There were no changes to the remainder of Section 11.8.4.2.

Add 11.8.4.3

11.8.4.3. Put the device into a net-zero mode by placing a small weight on the platform and taking a tare (push button tare) or by entering a keyboard tare and then placing an equivalent load on the platform. Confirm that the device will not go into a screen saver mode. Yes □ No □ N/A □

There is still a disagreement among NIST, regulators, and manufacturers concerning Handbook 44 Scales Code paragraph S.1.1. Zero Indication. and the interpretation of the discussion included in the 78th NCWM Specifications and Tolerances (S&T) Committee Item 320-1. This has resulted in inconsistent evaluations and weights and measures enforcement of scales and point-of-sale systems interfaces with scales that use methods such as screen saver, power saver, scrolling display, and modes of operation to indicate that a device is at a no-load condition.

In 1976, the 61st NCWM adopted paragraph G-S.6. Marking Operational Controls, Indications, and Features. In addition to a discussion on the marking of operator instructions, the discussion of the subject included a statement that there was "also a problem for customers to determine that those devices used in direct sales are being properly operated, and for weights and measures officials when encountering this equipment in the field for the first time."

NIST and some of the participating laboratories have stated that a weighing device shall be marked or an indication provided that states zero is represented by other than a digital zero (e.g., if a zero annunciator is provided, scale is marked with statements such as "scale at zero" or "scrolling" message indicates the scale is at zero). The customer must be provided adequate information (zero, net weight, unit price, and price to pay) to determine the validity of the transaction and make a determination to accept the transaction. (Note: The NIST technical advisor is not aware of customer complaints or concerns about a lack of a "digital zero" indication on scales and is interested if there have been issues raised from field officials and the public.)

The Report of the 78th of the NCWM Annual Meeting, S&T Committee Item 320-1 S.1.1. Zero Indication reported that there was early concern regarding alternative indications for indicating the zero balance condition of a scale. Comments submitted to the Committee, however, indicated that weights and measures officials were willing to accept alternative forms for indicating the zero balance condition if clearly defined.

Discussion: The Weighing Sector reviewed the above discussion. Manufacturers provided additional input that there have been no customer complaints on scales with "other than digital zero indications" without additional markings or annunciators and further state additional markings are not needed because customers are adequately protected by existing language in Handbook 44. It was also noted that customer-operated devices where the "automated" process helps ensure proper operation protect the customer more than additional markings.

The Sector discussed asking the NCWM S&T Committee for clarification regarding the applicability of marking requirements in General Code paragraph G-S.6. Marking Operational Controls, Indications and Features to "other than

digital zero indication" in Scales Code paragraph S.1.1.(c). The Sector considered recommending amended language in S.1.1.(c) to specifically state the intent of the 78th NCWM S&T Committee. The Sector also considered the following language to amend Handbook 44 drafted by the NIST technical advisor:

S.1.1. Zero Indication.

(b) A zero-balance condition may be indicated by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a weighing operation or to return to a continuous digital indication when the scale is in an out-of-balance condition and is marked or includes supplemental indications or markings to indicate that the "other than digital zero indication" represents a no-load condition of the scale.

OR

(c) A zero-balance condition may be indicated by other than a continuous digital zero indication without additional marking or indications, provided that an effective automatic means is provided to inhibit a weighing operation.

Conclusion: The Sector agreed that NTEP can evaluate the requirements in Handbook 44 Scales Code paragraph S.1.1.(c) and verify that the "other than digital zero indication" prevents the weighing operation if the scale is in an out-of-balance condition. No consensus was reached on additional marking requirements and interpretation of past S&T Committee reports. The Sector requested that the NIST technical advisor ask for a clarification of the past S&T Committee reports and that Handbook 44 be amended to clearly state the intention of the Committee through the NIST S&T Committee technical advisors. The Sector also requested the NIST technical advisor provide the S&T Committee the above- suggested language for Handbook 44 Scales Code paragraph S.1.1.(c) that is consistent with their interpretation of the past S&T Committee reports.

After the 2003 Sector meeting, the NIST technical advisor to the Weighing Sector submitted the request to the S&T Committee for clarification and requested the S&T Committee technical advisors amend NIST Handbook 44 Scales Code paragraph S.1.1.(c) to include the above-suggested language.

The NIST S&T Committee technical advisors balloted the Committee to: (1) confirm the intent of the past NCWM S&T discussions that additional markings or indications are required for weighing devices that indicate a zero balance other than by digital indication; and (2) amend S.1.1.(c) by adding language consistent with the NIST interpretation of General Code paragraph G-S.6 and Scales Code paragraph S.1.1.(c). The Committee agreed additional markings or indications are required for weighing devices that indicate a zero balance other than by digital indication, and the S&T Committee agreed to add a proposal to amend Scales Code paragraph S.1.1.(c) to its 2004 NCWM Interim Agenda.

20. Clarification of G-S.1. Identification (software)

The item was incorrectly identified in the agenda as an editorial recommendation on language adopted by the Conference at the 88th NCWM Annual Meeting, in July 2003. It was intended to amend 2003 NCWM S&T Agenda Item 310-1b. Additionally, this item was combined with the discussion of the following Weighing Sector Agenda Item 21.

21. G-S.1. Identification; Built-for-Purpose Software-Based Devices

Source: SMA and NCWM Specifications and Tolerance Committee

Background/Discussion: At the 2003 NCWM Annual Meeting, the Conference voted to adopt alternate methods of compliance with identification requirements for "not-built-for-purpose devices. The Committee received comments that similar alternate methods of identification be developed for "built-for-purpose" devices. The Committee agreed there appears to be no opposition to allowing the same alternate methods for providing required identification markings on Built-for-Purpose Software-Based Devices in a manner similar to that proposed for Not-Built-for-Purpose devices. The Committee believes the SMA proposal needs to be an information item to allow for further review and development by the NTETC Weighing and Measuring Sectors and the Regional Associations.

The Weighing Sector was asked to review, comment, or make recommendations to further develop language submitted by the Scale Manufacturers Association to the NTETC Measuring Sector and the NCWM Specifications and Tolerances Committee. The Sector also reviewed suggested proposals by a scale manufacturer and NIST S&T technical advisors.

Discussion/Conclusion: There were comments from several Sector members that the NCWM S&T Committee should address this item. It was pointed out to the Sector that the concept of allowing the display of G-S.1. Identification information originated from both the NTETC Weighing and Measuring Device Sectors and that the 2003 NCWM S&T Committee requested input from the both Sectors. Members of the SMA technical committee noted that they are continuing to develop language that applies equally to built-for and not-built-for-purpose devices and no longer support the language originally submitted at the 2003 NCWM Interim meeting. The Sector did not discuss the alternate proposal from NIST/WMD because they did not have sufficient time to review and discuss the new proposal.

The Sector agreed to make no recommendations on this item.

22. Publication 14 DES Section 8, Family Definition and Selection Criteria for Vehicle Scales, Railway-Track Scales, Combination Vehicle/Railway-Track Scales, and Other Platform Scales over 30 000 lb and up to and including 200 000 lb.

Source: Nebraska

Background: The Nebraska NTEP participating laboratory reported the parameters for large scales have been a source of confusion and misinterpretation. Additionally, the lower limits for size and capacity are not based on technical and design considerations. Nebraska submitted a proposal for consideration by the Sector. Briefly, the proposal eliminates the minimums for some of the parameters and the parameters for length and width. Nebraska believes the limits on the span between sections, combined with parameters on minimum platform area (similar to modular scale parameters), should be sufficient.

Also, there is a proposed limit on the number of sections if the device uses a lever system in the weighing element. If, for example, a 5-section scale is evaluated, it is not a given that a 6-section scale would perform adequately. With each section added, the "signal" must be transmitted through more levers to reach the indicating element, increasing the potential for a loss of sensitivity. This concern may also apply to fully electronic designs if the power supply is inadequate for the number of load cells in use, but an auxiliary power supply may overcome that concern. Nebraska would be interested in a response to the comment on auxiliary power supplies.

The final result would be a more uniform presentation of the parameters in the various portions of Section 8. For example, an 18' x 10' scale (180 sq. ft.) would be acceptable based on the evaluated device with sections of 20' x 14' (240 sq. ft.).

Discussion/Conclusion: The Sector reviewed and discussed the proposed changes to Publication 14 and agreed with the submitter's justification for amending the publication technical policy. The Sector agreed with the proposal as submitted except that the number of sections should not be limited to the device evaluated since any problem could be discovered during initial tests and by mechanical and load cell sensitivities. Additionally, the maximum length limitations in paragraphs 8.1.c and 8.2.c were reinstated.

Recommendation: The Sector recommends Publication 14 for Digital Electronic Scales, Sections 8.1, 8.2, and 8.3 be amended as follows:

8.1 Additional criteria for vehicle scales, railway-track scales, combination vehicle/railway-track scales, and other platform scales over 30 000 lb and up to and including 200 000 lb.

A CC will apply to all models having:

a. **nominal capacities** ~~from 50 %~~ up to 135 % of evaluated capacity;

b. **platform area** for any two-section portion no less than 50 % of the smallest two-section portion incorporated in the device evaluated.

~~b~~c. **widths** ~~from 70 %~~ up to 120 % of the width of the platform tested;[2]

~~e~~. **lengths** ~~from 50 % to~~ 150 % of the length of the platform tested~~;~~

d. ~~weighing elements in which the~~ a **span** between sections of ~~is~~ not more than 20 % greater than the equipment evaluated;

e. ~~a **number of sections** for weighing (SC? load-receiving) elements which incorporate a lever system up to the number of sections evaluated~~.

8.2 Additional criteria for vehicle scales, railway-track scales, combination vehicle/railway-track scales, and other platform scales greater than 200 000 lb.

A CC will apply to all models having:

a. **nominal capacities** ~~from 50 % to 100 % of~~ no greater than the evaluated capacity;

b. **platform area** for any two-section portion no less than 50 % of the smallest two-section portion incorporated in the device evaluated.

~~b~~c. **widths** ~~from 70 % to 100 % of~~ no greater than the width of the platform tested;[3]

~~c.~~ **lengths** ~~from 50 %~~ to 100 % of the length of the platform tested;

d. ~~weighing elements in which the~~ **spans** between sections of ~~is~~ not more than 20 % greater than the equipment evaluated;

e. ~~a **number of sections** for mechanical weighing (SC? load-receiving) elements up to the number of sections evaluated.~~

8.3 Modular Load-Cell Vehicle, Livestock, or Railroad Track Scales

*Not**e:** These criteria apply if the vehicle scale is fully electronic (i.e., load cells comprise the sensors of the weighing element) and is of a modular design.*

Modular scale. *A vehicle livestock or railroad track scale made up of individual load-receiving elements of like design which can be joined together to form a larger integral load receiving element and can be separated at any time without structurally change the individual load-receiving elements. This definition is to be applied for all new type evaluations and for applications to add new devices to an existing Certificate of Conformance (see figure 3). (Effective January 2001)*

8.3.1. Modular Scale to be Tested

The following criteria must be satisfied in the scale design and the scale to be tested:

a. Load cells of the same design and capacity that consists of simply attaching modules together must be used throughout the family. If load cells of different capacities are used for scales of different structural strength and capacity in the family, then the module using the higher capacity load cells must be evaluated.

[2] For scales with widths greater than 12 feet, this policy on range of widths may not be applied retroactively. Additional testing is required for devices with widths greater than 12 feet. NTEP management and the NTEP laboratories on a case-by-case basis will address test procedures for scales wider than 12 feet.

b. The CLC in the family must be not less than 40 % of the sum of the capacity of two load cells or 80 % of the capacity of one cell.

c. A scale with at least two modules must be tested. The module with the largest CLC is to be tested. If the longest span between sections is not tested, the Certificate of Conformance will include up to 120 % of the span between sections that was tested. Arrangements regarding the specific scale in the family to be tested will be established in consultation with NTEP representatives.

8.3.2. Range of Parameters for Modular Scales

The following range of parameters will be used to establish the sizes and capacities of modular load-cell vehicle scales that will be covered on a Certificate of Conformance based upon the test of a single scale.

a. **Nominal capacities** not more than 1.5 times CLC for a two-section scale to 135 % of capacity of the device evaluated. The nominal capacity for the railroad track scale in a modular vehicle/railroad combination will be no greater than the capacity of the device submitted for evaluation.

b. **Platform area** not less than 50 % of smallest two-section (four-cell) module incorporated in the device evaluated. Increased lengths for scales with two or more modules are not restricted as long as the width complies with 6(e) and the load cells meet the v_{min} formula (i.e., $v_{min} \leq d / \sqrt{n}$.) Additional modules to increase length must be of the same type as those used in the device submitted for evaluation (i.e., 4-cell, 2- cell, 0-cell.)

c. **CLCs** complying with the minimum CLC rating (i.e., not less than 80 % of the capacity of one cell) but not exceeding twice the capacity of one load cell.[2]

d. ~~**Modules** in which the span~~ **span(s)** between sections which is (are) not more than 20 % greater than the span of the largest two-section, four load-cell module ~~in the scale~~ evaluated.

e. **Widths** ~~from 70 %~~ up to 120 % of the width of the platform tested.[3]

f. **Nominal capacity** equal to or less than CLC times the number of sections minus one-half.

g. **Platform construction and material** similar to that of the device evaluated. (see section 8.e.)

h. **Scale division values** equal to or greater than the value of the scale division used in the scale that was evaluated.

i. **number of divisions (n_{max})** the number of scale divisions that would exist for scales included in the range of capacities provided it does not exceed the n_{max} of the load cells and indicator for the installed system.

   a. ~~module connection type~~ **module connection type** will be limited to the original type evaluated. The manufacturer may choose to submit a special hybrid design including more than one type of module connection. For example, one module can he connected using welded connections and another can be connected using bolted connections. The resulting CC will cover all the types submitted if the evaluation is successful.

23. Acceptable Abbreviations for Indicated and Recorded Representations.

Source: California NTEP Laboratory

Background: Handbook 44 General Code Section 1.10, Table 1. Representation of Unit does not include many abbreviations for units and symbols that are in use today in the U.S. Modern weighing and measuring devices are able to

print more common and not-so-common units of measure. During an NTEP evaluation, the lack of a complete list of acceptable abbreviations for units such as gallons, inches, ounces, and tons made it difficult to make a decision that a specific abbreviation was sufficient and will be uniformly accepted by other NTEP evaluators and field officials. A list of acceptable abbreviations in Handbook 44 would promote uniformity in type evaluation and field enforcement in addition to NTEP applicants.

This item was discussed at the April 2003 meeting of the participating laboratories. The original problem dealt with an evaluation of a vehicle-tank meter (VTM) controller used to deliver gasoline. In Publication 14 ECR checklist, "G" is permitted for the printed receipt but "GAL" was marked on the VTM controller. Publication 14 refers to recorded representations in that it allows "GAL" "G" "Gallon". Liter can be represented by "L" or "l' on a printed ticket. Information is supposed to match on indicated and recorded representations

Historically, the "G" was a compromise for the receipts issued by point-of sale systems and space limitations on the receipt tape. This is still an issue today, however, the primary concern remains that representation of units must be clearly defined. At the April 2003 NTEP participating laboratory meeting, it was noted in the discussion that Handbook 44 Code is somewhat specific. The letter "G" without product identity can lead to some interpretation issues. It was also discussed that Publication 14 Checklist for Electronic Cash Registers interfaced with Retail Motor-Fuel Dispensers could be amended to remove "G" as an acceptable solution in paragraph 3.1. It was also suggested that a note could be added to Publication 14 (Scales and LMD?) with a list of acceptable abbreviations that instructs the evaluator to refer to Handbook 44 Appendix C, Handbook-130 FPLA section 6.7.1., and NIST Publication 811 Guide for the Use of the International System of Units (SI) for additional and acceptable abbreviations.

The participating laboratories concluded that California should develop a list of acceptable abbreviations and submit it to the 2003 Western Weights and Measures Association Technical Conference and to both NTETC Weighing and Measuring Device Sectors for consideration.

California proposed to add the following abbreviations to Handbook 44 General Code Table 1.

Add the following abbreviations to Table 1:

Name of Unit	Common Use Symbol	Representation			Name of Unit	Common Use Symbol	Representation		
		Form I	Form II				Form I	Form II	
		(double case)	(single lower case)	(single case upper)			(double case)	(single lower case)	(single case upper)
inches	In	In	in	IN	centiliter	CL	cL		
foot	Ft	ft	ft	FT	deciliter	dL	dL		
yard	Yd	yd	yd	YD	kiloliter	kL	kL		
milligram	Mg	mg	mg		cubic meter	M^3	m^3	m^3	M^3
megagram	Mg	Mg			cubic inches	in^3	in^3	in^3	IN^3
grain	Gr	gr	gr		cubic foot	ft^3	ft^3	ft^3	FT^3
dram	Dr	dr	dr		cubic yard	yd^3	yd^3	yd^3	YD^3
ounce	Oz	oz	oz	OZ	gills	gi	gi	Gi	GI
pound	Lb	lb	lb	LB	pint	pt	pt	pt	PT
hundredweight	Cwt	cwt	cwt	CWT	quart	qt	qt	qt	QT
pennyweight	Dwt	dwt	dwt	DWT	gallon	gal	gal	gal	GAL
ounce troy	oz t	oz t	oz t	OZ T	ampere	A, I	A, I		A, I
milliliters	ML	mL			resistance	ohms	ohms	ohms	OHMS

Discussion/Conclusion: The Sector reviewed the proposed table and noted there were some omitted and incorrect abbreviations. One of the manufacturers suggested that national and international documents be referenced instead of continually updating the table. Several other Sector members responded that the referenced documents might not be available to field officials. Additionally, there are no suggested abbreviations for "ton" and the abbreviations for mega gram and milligram are the same in "Common Use Symbol" column. The Sector recognizes the concern of the NTEP laboratories and supports the concept of expanding Handbook 44 General Code Table 1. However, the Sector is

concerned that there might be additional omissions and conflicting abbreviations and suggests that the proposal to expand Table 1 be thoroughly checked for accuracy by the California NTEP lab and other interested parties.

24. Acceptable Abbreviations for "Section Capacity."

Source: Rice Lake Weighing Systems (RLWS)

Background: RLWS reported that some field officials are not accepting abbreviations for "Section Capacity" on livestock and railway-track scales. Additionally, there is not enough room to spell out "Section Capacity" on some manufacturers' ID badges. Rice Lake, for example, only allows five characters for an identifier. RLWS submitted to the Western and Central Weights and Measures Association S&T Committee for consideration at its annual meeting in September 2003 a proposal to renumber Handbook 44 Scale Code paragraphs S.6.4. and S.6.5., add S.6.4.3., and modify Table S.6.3.a.

Discussion: The Sector reviewed and discussed RLWS's proposal and also considered alternatives such as recommending that the proposed acceptable abbreviations need only be included in Publication 14, incorporating the recommended abbreviations for "section capacity" in Handbook 44 definition of "section capacity", to be consistent with other code definitions such as e, $e_{min,}$ CLC, GGE, NBP, n_{max}, etc.), and adding a new note to Handbook 44 Scales Code Table S.6.3.b. The Sector also noted that the abbreviations "SC," "S Cap," and "sec" should not be used since they could be confused with the abbreviations for "scale capacity" and "second."

Conclusion: The Sector agrees with the problem identified by RLWS except for the proposed "SC" abbreviation. The Sector recommends the following alternative language that amends Table S.6.3.a. and adds a new note to Table S.6.3.b. as follows:

Table S.6.3.a.
Marking Requirements

	Weighing Equipment				
To Be Marked With ⇓	Weighing, load-receiving, and indicating element in same housing or covered on the same CC[1]	Indicating element not permanently attached to weighing and load-receiving element or covered by a separate CC	Weighing and load-receiving element not permanently attached to indicating element or covered by a separate CC	Load cell with CC (11)	Other equipment or device (10)
Manufacturer's ID (1)	x	x	x	x	x
Section Capacity <u>and Prefix</u> (14)(20)(22)<u>(24)</u>		x	x		

Table S.6.3.b.
Notes For Table S.6.3.a.

23. Required only if a CC has been issued for the device or equipment. [Nonretroactive as of January 1, 2003]
(G-S.1. Identification (h) Added 2001)

<u>24. The section capacity shall be prefaced by the words "Section Capacity" or an abbreviation of that term. Acceptable abbreviations shall be "Sec Cap" or Sec C" and may be initial capitals, all capitals, or all lower case, and with or without periods</u>

25. Additional Items

25a. Permanence Test of Floor Scales

Submitted by: Bob Hamilton (Mettler Toledo)

Background: The 2003 Edition of the Publication 14 checklist for digital electronic scales section 62 is titled "Performance and Permanence Test for Counter (Bench) Scales (including Computing Scales)." However, paragraph 62.5 applies to "instruments up to and including 2000 lb." Paragraph 62.6.4.1 specifies 100 000 cycles for the permanence test. Section 63 is titled "Performance and Permanence Test for Floor Scales" and Section 63.1.1 specifies 300 weighing operations. There appears to be a conflict with the terminology used in Sections 62 and 63 where scales that do not fit the definition of bench/counter scales are tested differently based upon their capacity. The submitter proposed that the language in Publication 14 be changed as follows:

> 62.5. Laboratory Permanence tests for Bench, Counter, and Computing Scales ~~(Applicable only to instruments up to and including 2000 lb capacity).~~
>
> Add new paragraph:
>
> 63.1.3.1. As an alternative test for floor scales up to and including 2000 lb (1000 kg) conduct a laboratory permanence test at one-half capacity, (300) weighing operations.

Discussion: The submitter reported that permanence testing is only conducted on scales up to 220 lb (100 kg) for OIML evaluations. The NIST technical adviser stated that the original Publication 14 language was based upon the capacities of scales that could be tested at an NTEP laboratory. The field permanence test for scales greater that 2000 lb was a compromise with the states that conducted 90-day field permanence tests on all scales, regardless of the capacity. The type evaluation states felt that time should be a factor influencing permanence in lieu of 100 000 cycles of load application. The NTEP Director questioned the need for permanence testing and requested that the participating laboratories compile pass/fail data from permanence tests. Some of the participating laboratories suggested that the titles for the permanence testing section be updated and be based upon scale capacity. It was also noted that Publication 14, Section 61 is titled "Performance and Permanence Tests for Scales and Electronic Cash Registers" (ECRs). A different chapter in Publication 14 already covers ECRs.

Conclusion: The NTEP Director will request permanence test compliance data from the participating laboratories and make editorial corrections the Publication 14 sections 61, 62, and 63.

25b. Series and Model Designations that Clearly Identify Pattern and Design of the Device

Submitted by: Bill Fishman, New York

Background: The New York participating laboratory reported on applications where the "Series" designation for the family had no relation to the specific device model designation. This does not present a problem for type evaluation. However, it does create a problem for field inspections when an inspector tries to look up a Certificate of Conformance (CC) based upon the model designation marked on the device. An inspector would have trouble using the NTEP CC database if the Series designation listed in the CC is "Fish" and the model designation marked on the device is 500 to verify that an NTEP CC covers the model 500.

Discussion/Conclusion: The participating laboratories agreed that this might be a concern when conducting field inspections when an inspector tries to look up a CC based upon the model designation marked on the device. In order to compel an applicant to establish and mark a device with a designation that clearly identifies the pattern or design of the device and that the specific model designation be based on the series designation, the Sector considered recommending that NTEP cite Handbook 44 General Code paragraph G-S.1-Identification. It was also noted that all devices manufactured after January 1, 2003, that have an NTEP CC shall be marked with the CC Number making it easier for the field inspector to associate the model designation with its associated CC.

The Sector concluded that the NTEP Director and participating laboratories work to determine if a standard process needs to be developed to provide additional guidance in the uniformity of model, type, and pattern designations, and information on the CC.

26. Next Meeting

The next Weighing Sector meeting is scheduled for September 2004 in Canada. Please contact the Sector Technical Advisor Steven Cook, NIST WMD to propose items for future meetings. Mr. Cook can be reached by telephone at 301-975-4003, by fax at 301-926-0647, by e-mail at stevenc@nist.gov, or in writing at NIST, 100 Bureau Drive – Stop 2600, Gaithersburg, MD 20899-2600.

ATTACHMENTS

Attachment for Item 2

65a.2. Shift and Section Tests (Initial Performance Testing)

A **shift test** is defined in Handbook 44 as a test intended to disclose the weighing performance of a scale under off-center loading. [2.20]

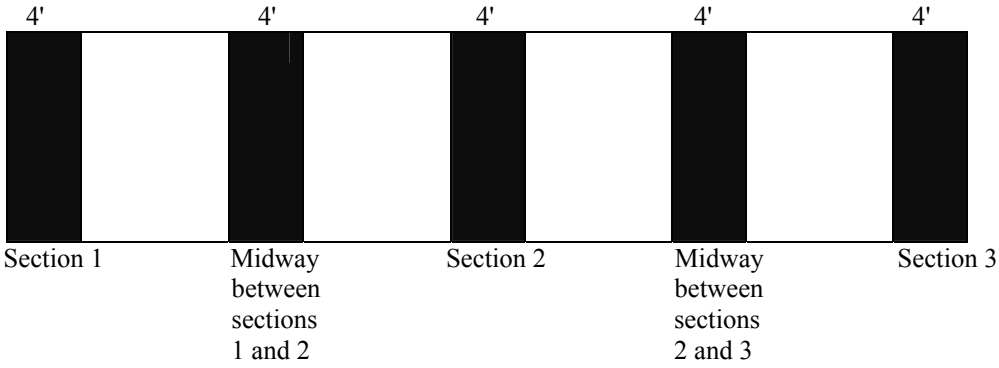
A section test is defined in Handbook 44 as a **shift test** in which the test load is applied over individual sections of the scale. This test is conducted to disclose the weighing performance of individual sections, since scale capacity test loads are not always available and loads weighed are not always distributed evenly over all main load supports. [2.20]

The minimum amount of ***test weights*** to conduct the **shift and section tests** ~~shall be at least~~ 90 % **of the** CLC.

Record the time and temperature at the beginning and end of each complete **shift** test load test. The scale shall be capable of returning to zero within prescribed limits if the temperature has not changed more than 5 ^{o}C (9 ^{o}F) (T.N.8.1.3.) or within 15 minutes after the load was removed (creep recovery).

*Unless otherwise stated in the following procedure**, the** increasing and decreasing loads (using **known** test weights) shall be conducted with at least **five test loads (e.g. 500, 1000, 2000e...).** ~~steps.~~ (NOTE) If possible, the first ~~increment of test weights~~ **test load** should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.*

An example of a three-section scale:



65a.2.1. Conduct at least two complete sets of **shift** ~~section~~ tests over each **section** to at least 90 % of the concentrated load capacity (CLC) of the scale. When analyzing the return to zero, consideration must be given for the length of time the load was on the scale and possible temperature changes that may have occurred during the test.

(a). Begin ~~T~~the ~~section~~ **shift** test ~~will be conducted~~ by loading one end **section** to the first of at least five test loads, and record the error ~~moving the load to each **section**~~.

(b) Move ~~Record the error moving~~ the **test** load to **the next** ~~each~~ **section and record the error. Repeat these steps** at each **section** until the opposite end of the scale is reached. Record ~~recording~~ the error at each **section** ~~and at each load~~.

(c) Repeat ~~the section **shift** test procedure above in~~ steps a, and b ~~above~~ for each test load ~~at increasing weight increments~~ until at least 90 % of the CLC is reached. A minimum of five test loads is required.

NOTE: While at the maximum test load **(90 % of the CLC) and** during ***one of the shift tests*, place** ~~locate~~ the test weights ~~and record the errors~~ at mid-span between **sections and record the error**~~., and on~~
On modular scales, **place the test weights on one side of and across the weighing element where the modules connect. Repeat this procedure on the other side of the module connection line and at each section.** ~~each on the center, right and left side of the module connection line located at each section.~~

(d) **When steps a to c are complete** conduct a decreasing load test ~~on the **section**~~ at the end of the scale where the weights can be reloaded. **Record the error and section where this test was performed.**

~~*(NOTE) If possible, the first increment of test weights should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.*~~

~~65a.3 Shift Test~~

~~While at the maximum test load, locate the test weights and record the errors at mid span between sections, and on modular scales, each on the right and left side of the module connection line located at each section. This can be done in conjunction with one of the section tests.~~

65a.4. Strain Load Test (Initial Performance Testing)

The minimum amount of ***test weights*** used shall be the same loads used to conduct the shift tests.

Acceptance tolerances are applied only to the known test load in the strain load test.

Record the time and temperature at the beginning and end of each complete strain load test. The scale shall be capable of returning to zero within prescribed limits if the temperature has not changed more than 5 ^{o}C (9 ^{o}F) (T.N.8.1.3.) or within 15 minutes after the load was removed (creep recovery).

Unless otherwise stated in the following procedure, increasing and decreasing loads (using test weights) shall be conducted with at least five steps. (NOTE) If possible, the first increment of test weights should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.

65a.4.1. Conduct at least one strain load test at each end of the scale. The maximum load applied during the strain load shall be in the range of 80 % to 100 % of scale capacity. Distribute the load over the load-receiving element.

65a.4.2. For the first test, ~~L~~load the scale with a vehicle or vehicles so the addition of test weights will provide a gross load of 80 % to 100 % of scale capacity. Determine the "reference point" for the start of the strain load test. Add the test weights to one of the ends of the scale without exceeding the CLC in the prescribed test pattern. (*The test weights do not have to be in a prescribed test pattern and may be distributed over the available area of the platform or on the vehicle(s).)*

Different text for this section: Need to clarify

For the first test, ~~L~~load the scale with a vehicle or vehicles so the addition of test weights will provide a gross load of 80 % to 100 % of scale capacity. Determine the "reference point" for the start of the strain load test. Add the test weights to one of the ends of the scale without exceeding the CLC prescribed

test pattern and record the strain load value. (***The test weights ~~do not have to~~ will be in a prescribed test pattern for the section at the end of the scale. ~~and may be distributed over the available area of the platform or on the vehicle(s).)~~***. ***(SC recommends that the weights be distributed since the section and shift tests have already been conducted and the section may be overloaded when test weight are added in a concentrated load pattern to the unknown load is already on the scale.)***

65a.4.3. ~~Do not conduct a decreasing load test or a return to the strain load reference weight as part of this particular strain load test.~~ ~~After removing~~ Remove the test weights from the end of the scale without conducting a decreasing load test, re-establish the strain load reference value and re-apply the test weights to verify that the strain load values repeat the initial values. The scale shall perform within prescribed tolerances based upon tolerance for the known test load (The actual strain load indication after the application of the known test load shall agree within the target strain load test indication within prescribed limits. [Question: What limits are prescribed? Acceptance tolerance? Maintenance tolerance since this is somewhat of a repeatability test? Other? Don't know?(WW)] Conduct a decreasing load test and return to the strain load reference value as the weights are removed as part of this test cycle. [Another question: Is the increasing/decreasing load test done in 5 steps or is the weight placed on the scale all at once and removed all at once? There was considerable discussion on this at the Lab meeting, but I don't recall that we reached a consensus. I believe the intent of the procedure was that an increasing/decreasing load test be done in steps, not all at once. (WW)] The return to the strain load reference value shall be within one-half of a scale division considering creep and any temperature changes that may have occurred during this last test cycle. Remove the ~~known test weights and the~~ strain load. Do not apply zero return tolerances at this time.

65a.4.4. ~~Remove the known test weights and the strain load.~~ For the second test, ~~Z~~zero the scale; place the strain load (vehicles or material of unknown weight) on the other end of the scale; establish the strain load reference value. During the second test, the semi-automatic tare mechanism may be used to tare out the strain load value (Net weight indications used for the increasing load test.) Do not use the zero-setting mechanism to set the strain load to zero~~; use the tare mechanism to tare out the strain load. Use the gross load zero value to conduct a decreasing load test when removing the strain load in the next test~~.

65a.4.5. ~~Repeat the strain load test on the other end of the scale~~ Add the test weights the other end of the scale without exceeding the CLC in the prescribed test pattern. (*The test weights do not have to be in a prescribed test pattern and may be distributed over the available area on the platform or on the vehicle(s).)* The scale shall perform within prescribed tolerances based upon tolerance for the known test load (The actual strain load indication after the application of the known test load shall agree with the target strain load test indication within prescribed limits). After reaching the maximum test load for the strain load test, remove the strain load (vehicles or material of unknown weight) but leave the known test weights on the scale. Use the "gross weight" indications to conduct a decreasing load test after removing the strain load in the next test. The weight indication for the decreasing load test must be within tolerance for the known test load. Continue the decreasing load test by removing the known test weights. ~~Take several readings as the weights are being removed.~~ ***(Should the previous strikeout language should be left in?)*** When all the weights are removed, record the return to zero. The scale must return to zero within one-half of a scale division. ~~When analyzing the return to zero, consideration must be given for the length of time the load was on the scale and possible temperature changes that may have occurred during the test.~~

~~65a.4.6. Acceptance tolerances are applied only to the known test load in the strain load test.~~

65a.5. Subsequent Type Evaluation (Field) Permanence Tests

The minimum amount of ***test weights*** for the shift and strain load tests shall be:
a minimum of 40 000 lb, or
50 % of the CLC whichever is greater,
(one of the labs recommends that this should be 90 %) ~~5~~90 % of the CLC whichever is greater,

Acceptance tolerances are applied only to the known test load in the strain load test.

Record the time and temperature at the beginning and end of each complete strain load test. The scale shall be capable of returning to zero within prescribed limits if the temperature has not changed more than 5 °C (9 °F) (T.N.8.1.3.) or within 15 minutes after the load was removed (creep recovery).

Unless otherwise stated in the following procedure, increasing and decreasing load test results (using test weights) shall be recorded at a minimum of three test loads (zero, approx. ½ maximum test weights, and at maximum test weights).

65a.5.1. The minimum number of days that a device is required to be in use is 20. It is not required that a certain number of weighing operations be conducted each day for the test period. Performance during both tests must be within acceptance tolerances. ***(Should This Section Be Moved To Section 65a.7.?)***

65a.5.2. Conduct at least one complete set of ~~section~~ **shift** tests over each **section**, at mid-span between each **section** and on modular scales, each on the center, right and left side of the module connection line ~~located at each section, using minimum of 40 000 lb of known test weights or 50 % of the CLC whichever is greater~~.

65a.5.3. Conduct at least one complete set of strain load tests ~~at each end of the scale~~ using the "Strain Load Test" procedures above. The maximum applied load shall be in the range of 65 % to 100 % of scale capacity. (or should this be?) of ~~65~~ 80 % to 100 % of scale capacity.

65a.5.4. If the device does not meet these tolerance limits, the entire test must be repeated, including successful initial performance testing and a subsequent test after a minimum of 20 days.

Attachment for Items 10 and 11

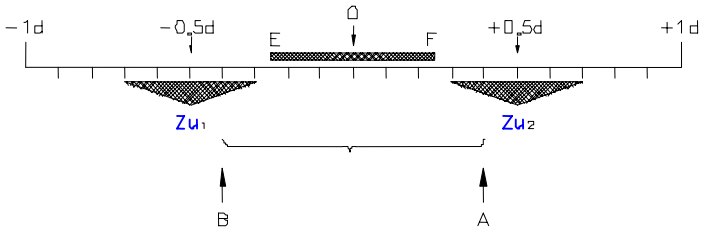
LG-15.01 Center-of-zero indication and setting zero within ± 1/4 e

APPLICATION: Applicable to complete electronic scales and separate electronic indicators having SAZSM or IZSM or equipped with a "center-of-zero" indicator.

PURPOSE: This test is to verify that the SAZSM and IZSM automatically set the device to zero within ± 1/4 of **e**, and to verify that the device range of center-of-zero indication is equal to or less than ± 1/4 **e**. Note that the range of center-of-zero indication of Class I or II devices equipped with auxiliary reading means is ± 1/2 of **d**. This must be taken into consideration when performing the following tests and interpreting the results. **Take into account that the ZU of weight classifiers is adjacent to the graduation**.

PROCEDURE: Setting zero to within ± 1/4 **e**.

A) Switch the AZSM off or set its value to zero effect; zero the DUT.
B) Place a load of at least **e** (made of 1/10 e weights) on the platter and RE-ZERO the device.
C) Successively remove small denomination weights in 1/10 x **e** steps until the low end of the interval is reached (the indication begins to alternate between 0 and -1 **e**). Record the weights removed as being the negative portion of the interval.
D) Successively add small denomination weights in 1/10 x **e** steps until the high end of the interval is reached (the indication begins to alternate between 0 and +1 **e**). Record the value of the weights added and subtract the value of the weights recorded in C. The difference is the positive portion of the interval.
E) Determine if the zero position as set by the SAZSM does not deviate from the true zero reference point by more than 1/4 **e**. Generally, the zero position, as automatically set by the SAZSM, should coincide with the zero reference point; in such a case, the negative range would equal the positive range. See illustration.



A=Lower limit of Zu2
B=Upper limit of Zu1
A−B=8/10Xd
O=True zero position
(theoritical zero position)
OE=1/4d
OF=1/4d
EF=Maximal range of zero setting

F) Repeat the test by zeroing the device using the IZSM.

Width of the centre-of-zero indication (Annunciator)

G). Switch the AZSM off or set its value to ZERO effect.
H) Set the device to zero.
I) Place a load of at least **e** (made of 1/10 **e** weights) on the platter; zero the DUT.
J) Successively remove small denomination weights in 1/10 x **e** steps until the visual confirmation of zero goes off. Record the value of the weights removed as being the negative portion of the center of zero indication.

K) Successively add small denomination weights in 1/10 x **e** steps until the center-of-zero indicator goes off (positive limit). Record the difference between the value of the weights remaining on the platter and the value of the weight recorded in **J** as being the positive portion of the center-of-zero indication.

INTERPRETATION OF RESULTS: The DUT is deemed to comply with the requirements if the zero setting mechanisms automatically set the device to zero within ± 1/4 of **e** from the true zero reference point, and if the centre-of-zero annunciator indicate a zero balance condition within ± 1/4 **e** of the true zero reference point.

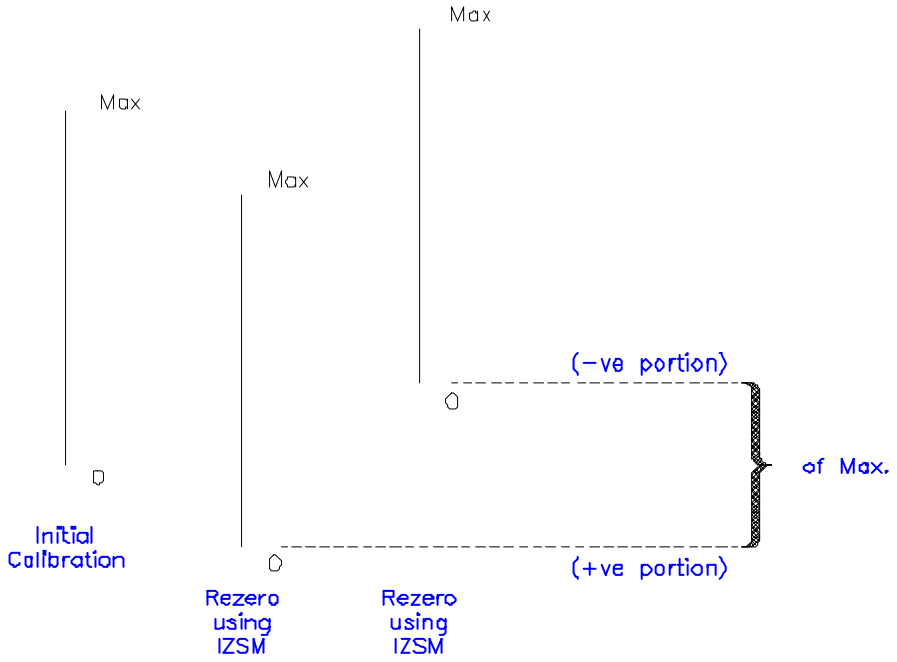
Note that for Class I or II devices with auxiliary reading means, the range is ± 0.5 d.

LG-15.04 IZSM Range (Maximum Range of Initial Zero Setting Mechanism)

APPLICATION: This test is applicable to electronic indicators and to complete electronic devices.

PURPOSE: The purpose of this test is to determine whether or not the total range of the initial zero setting mechanism exceeds 20 %. The initial zero setting mechanism is the mechanism that sets the scale to zero upon power up.

CLARIFICATION
Electronic indicators tested and approved separately: The load-receiving element to which an electronic indicator tested and approved separately will be interfaced will not have been tested up to 200 % of Max. Consequently, the maximum Initial Zero Setting Mechanism range of electronic indicators must be limited to 20 * of Max.

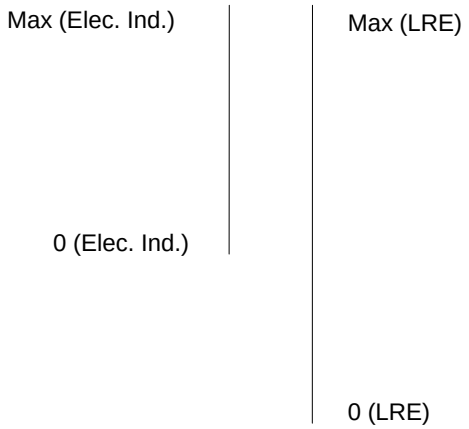


TEST PROCEDURE

Electronic indicators

Note: The following explanation of the test procedure is based upon the use of a load-receiving element connected to the electronic indicator because it is easier to explain the procedure this way. However, the actual test can be

performed using a load cell simulator or a rheostat provided that the basic principles are maintained. The procedure consists of calibrating the electronic indicator so that it only uses a small portion of the total capacity of the LRE.



A) Connect the indicator to a LRE and calibrate the indicator so that it is at a zero balance condition when the LRE is loaded at 50 % of its maximum capacity and that it displays the number of intervals "n" (as requested by the applicant) when the LRE is fully loaded (Cap).

B) By trial and error, find the -ve portion of the electronic indicator's IZSM range by removing a load(s) from the LRE and by trying to zero it using the electronic indicator's IZSM. The IZSM is triggered by unplugging and replugging the power cord (Note: on some devices, it is sufficient to switch it off and on).

a) Similarly, by trial and error, find the +ve portion of the electronic indicator's IZSM range by adding a load(s) to the LRE and by trying to zero it using the electronic indicator's IZSM.

Complete electronic scale

Note: Whenever possible, perform the procedure described above for electronic indicators tested separately; or.

D) Remove the platter in order to reach the lowest point of the IZSM range.

E) By trial and error, find the +ve portion of the electronic indicator's IZSM range by adding a load(s) to the LRE and by trying to zero it using the electronic indicator's IZSM. The IZSM is triggered by unplugging and re-plugging the power cord (Note: on some devices, it is sufficient to switch it off and on).

INTERPRETATION OF RESULTS

An electronic indicator tested and approved separately is deemed to comply with the requirements when the total range of the Initial Zero Setting Mechanism (absolute value of -ve portion of the range plus the +ve portion of the range) does not exceed 20 % (or can be set to a maximum of 20 % and sealed) of the DUT's maximum capacity (Max);

The IZSM range of a complete electronic device may exceed 20 % of Max if the device performs within tolerances when the IZSM is set at the minimum and maximum points of its range.

When the IZSM range is limited to 20 %, performance tests are conducted once: at the maximum IZSM setting. When the IZSM range exceeds 20 %, certain performance tests are conducted twice: at the minimum and at the maximum setting of the range. See description of the performance tests in Part 3.

WELMEC 2.1
(Issue 3)

WELMEC

European cooperation in legal metrology

Guide for Testing Indicators
(Non-automatic Weighing Instruments)

February 2

From WELMEC 2-1

ANNEX 2
SPECIFICATION OF SENSITIVITY

The value of the verification scale interval is expressed in μV per verification scale interval in the case of strain gauge measurement.
The reasons for fixing this value are the following:

- It specifies the maximum sensitivity of the indicator, which is a very important parameter, in the correct way.
- By specifying the maximum sensitivity of the indicator the maximum amplification is fixed, which is very important for the signal/noise ratio.
- The drift in offset-voltage of the amplifier can be seen as zero-drift. The smaller the input voltage per VSI, the larger the influence of that drift. For a certain small value of the input signal per VSI, the indicator will no longer comply with 3.9.2.3 of EN 45501.
- The VSI cannot be expressed in units of mass because generally it is not known what capacity load cell will be connected to the indicator.

Furthermore it is an easy parameter to evaluate the proper combination with a load cell. The following example elucidates this.
The indicator is tested under the following conditions with a load cell:

1 the sensitivity of the load cell is 2 mV/V;
2 the excitation power supply is 10 V;
3 the load cell weighing range is 3 % of maximum capacity;
4 the number of verification scale intervals is 6000 VSI;
5 therefore the unit per verification scale interval expressed in microvolts is:
(2 [mV/V] 10 [V] 30%) / 6000 VSI = 1 μV/VSI.

The test is carried out and, if the indicator performs within the MPE allowance with respect to the value calculated under 5, a test certificate is issued.
If the manufacturer of a weighing instrument combines the indicator with a tested load cell that does not have a sensitivity of 2 mV/V but 1 mV/V while the other parameters described above remain the same, then the indicator will have a unit per verification scale interval of 0.5 μV/VSI instead of 1 μV/VSI. In this case the instrument will possibly not comply with the requirements for the temperature effect on no load indication (3.9.2.3 of EN 45501).
From OIML R-76-1:

Annex A. Test Procedures

A.4.4.2 Supplementary weighing test (4.5.1)

For instruments with an initial zero-setting device with a range greater than 20 % of Max, a supplementary weighing test shall be performed using the upper limit of the range as zero point.

A.4.2.1.1 Initial zero-setting

With the load receptor empty, set the instrument to zero. Place a test load on the load receptor and switch the instrument off and then back on. Continue this process until, after placing a load on the load receptor and switching the instrument on and off, it does not re-zero. The maximum load that can be re-zeroed is the positive portion
of the initial zero-setting range.

Remove any load from the load receptor and set the instrument to zero. Then remove the load receptor (platform) from the instrument. If, at this point, the instrument can be reset to zero by switching it off and back on, the mass of the load receptor is used as the negative portion of the initial zero-setting range.

If the instrument cannot be reset to zero with the load receptor removed, add weights to any live part of the scale (e.g. on the parts where the load receptor rests) until the instrument indicates zero again.

Then remove weights and, after each weight is removed, switch the instrument off and back on. The maximum load that can be removed while the instrument can still be reset to zero by switching it off and on is the negative portion of the initial zero-setting range.

The initial zero-setting range is the sum of the positive and negative portions. If the load receptor cannot readily be removed, only the positive part of the initial zero setting range need be considered.

From R76-2 Test Form

Automatic zero-setting and zero-tracking device is:

☐ Non-existent	☐ Not in operation	☐ Out of working range	☐ In operation

Initial zero-setting > 20 % of Max:	Yes	No	(see R 76-1, A.4.4.2)

E = I + 1/2 e))L) L
E_c = E) E_0 with E_0 = error calculated at or near zero(*)

Load L	Indication I		Add. load)L		Error E		Corrected error E_c		mpe
	9	8	9	8	9	8	9	8	
(*)					(*)				

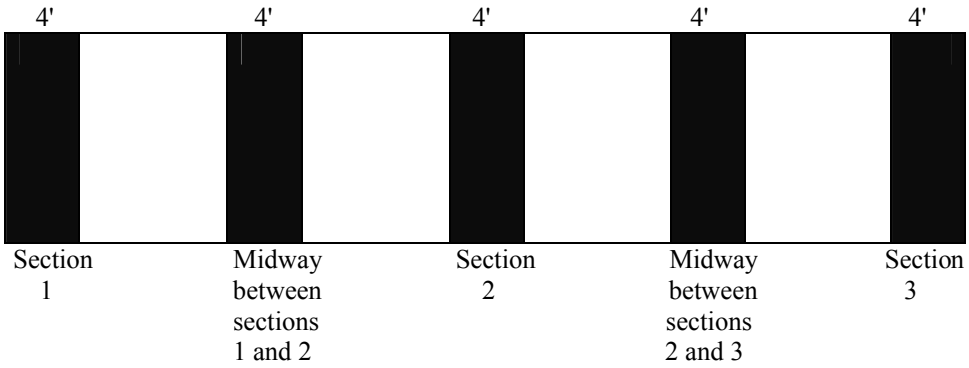
☐ Passed ☐ Failed

Remarks:

65(a.). Performance and Permanence Tests for "Single Load Receiving Element" Legal for Highway Vehicle Scales and Permanently-Installed Axle-Load Scale Weighing Elements

65a.2. Section Tests

An example of a three-section scale:



65a.2.1. Conduct at least two complete sets of section tests over each section to at least 90 % of the concentrated load capacity (CLC) of the scale. A single complete shift test is defined in steps a through d. When analyzing the return to zero, consideration must be given for the length of time the load was on the scale and possible temperature changes that may have occurred during the test.

(a) The section test will be conducted by loading one end section to the first of at least five test loads, moving the load to each section.

(b) Record the error moving the load to each section until the opposite end of the scale is reached, recording the error at each section and at each load.

(c) Repeat the section test procedure above in steps a, and b above for each weight increment until at least 90 % of the CLC is reached.

(d) Conduct a decreasing load lest on the section at the end of the scale where the weights can be reloaded.

(NOTE) If possible, the first increment of test weights should equal 500e. If weights cannot be conveniently applied that equal 500e, the first load should equal just below 500e as nearly as possible. The other tolerance breakpoints should be tested if possible.

65a.3 Shift Test

While at the maximum test load, locate the test weights and record the errors at mid-span between sections, and on modular scales, each on the right and left side of the module connection line located at each section. This can be done in conjunction with one of the section tests.

65a.4. Strain-load Test

65a.4.1. Conduct at least one strain-load test at each end of the scale. The maximum load applied during the strain-load shall be in the range of 80 % to 100 % of scale capacity. Distribute the load over the load receiving element.

65a.4.2. Load the scale with a vehicle or vehicles so the addition of test weights will provide a gross load of 80 % to 100 % of scale capacity. Determine the "reference point" for the start of the strain-load test. Add the test weights to one of the ends of the scale without exceeding the CLC.

65a.4.3. Do not conduct a decreasing load test or a return to the strain-load reference weight as part of this particular strain-load test. After removing the test weights from the end of the scale, re-establish the strain-load reference value and re-apply the test weights to verify that the strain-load values repeat the initial values. Conduct a decreasing load test and return to the strain-load reference value as the weights are removed as part of this test cycle. The return to the strain-load reference value shall be within one-half of a scale division considering creep and any temperature changes that may have occurred during this last test cycle.

65a.4.4. Remove the known test weights and the strain-load. Zero the scale; place the strain-load on the other end of the scale; establish the strain-load reference value. Do not use the zero-setting mechanism to set the strain-load to zero; use the tare mechanism to tare out the strain-load. Use the gross load zero value to conduct a decreasing load test when removing the strain-load in the next test.

65a.4.5. Repeat the strain-load test on the other end of the scale. After reaching the maximum test load for the strain-load test, remove the strain-load but leave the known test weights on the scale. The weight indication for the decreasing load test must be within tolerance for the known test load. Continue the decreasing load test by removing the known test weights. Take several readings as the weights are being removed. When all the weights are removed, record the return to zero. The scale must return to zero within one-half of a scale division. When analyzing the return to zero, consideration must be given for the length of time the load was on the scale and possible temperature changes that may have occurred during the test.

65a.4.6. Acceptance tolerances are applied only to the known test load in the strain-load test.

65a.5. Subsequent Type Evaluation (Field) Permanence Tests

65a.5.1. The minimum number of days that a device is required to be in use is 20. It is not required that a certain number of weighing operations be conducted each day for the test period. Performance during both tests must be within acceptance tolerances.

65a.5.2. Conduct at least one complete set of section tests over each section, at mid-span between each section and on modular scales, each on the right and left side of the module connection line located at each section, using minimum of 40 000 lb of known test weights or 50 % of the CLC whichever is greater.

65a.5.3. Conduct at least one strain-load test at each end of the scale. The maximum applied load shall be in the range of 65 % to 100 % of scale capacity.

65a.5.4. If the device does not meet these tolerance limits, the entire test must be repeated, including successful initial performance testing and a subsequent test after a minimum of 20 days.

65a.6. Caution Regarding Load Concentration

Concentrating large loads on scale platforms by using weight carts or test equipment using hydraulic jacks may exceed the maximum pound per square inch load specification for the deck. This condition may arise because the small tire area of the weight cart in contact with the deck surface could result in a very large load concentration over an unusually small area. This could cause damage to the scale deck.

This situation may occur with a weight cart having a very narrow or short wheelbase and small solid rubber tires. This is causes a problem on steel plate decks and could also result in damage to manhole covers. If the load

capacities of weight carts increases beyond 25 000 lb, while maintaining solid tread wheels, it is possible that some concrete decks could be damaged.

65a.7. Permanence Test Use Requirements for Vehicle Scales

65a.7.1. A minimum of 300 weighing operations are required during the test period. The manufacturer is to log the date, time, and weight. The person conducting the weighing is to initial each testing.

65a.7.2. Only loads which reflect "normal" use, will be counted during the permanence-testing period.[3]

65a.7.3. For vehicle scales with a nominal capacity over 75 000 lb:

65a.7.3.1. 50 % of the loads must be above 50 000 lb or 80 % of the CLC, whichever is greater; and

65a.7.3.2. 100 % of the loads must be above 20 000 lb or 50 % of the CLC, whichever is greater.

65a.7.4. For all other scales:

65a.7.4.1. 50 % of the loads must be above 50 % of the scale capacity; and

65a.7.4.2. 100 % of the loads must be above 20 % of the scale capacity.

65a.7.5. The minimum number of days that a device is required to be in use is 20. A minimum number of weighing operations to be conducted each day for the test period is not specified; however, the weighments should represent the scale's normal in-service use.

65a.7.6. The device will be tested to at least the CLC on the second test.

NOTE: *Substitution or strain test methods are acceptable as long as all conditions are met.*

[3] The scale may be used to weigh other loads, but only the loads identified are counted as part of the permanence test.

Appendix E

NTEP Committee Hearings

Interim Meetings
January 15-18, 2004

Committee Members

- Ross Andersen, NY, NTEP Chairman
- Dennis Ehrhart, AZ, NCWM Chairman
- Dave Frieders, San Francisco, CA, Chairman Elect
- Don Onwiler, NE
- Stephen Pahl, TX
- Stephen Patoray, NTEP Director, Technical Advisor
- Steven Cook, NIST Technical Advisor

NTEP Program Operation

- Consolidating Device Types
  - Helps Labs appropriately classify devices
  - Makes searches of database more meaningful
- Laboratory Training/Authorization
- Round Robin Update
- 2003 Sector Meetings

NTEP Meetings for 2004

- Laboratory Meeting - Ottawa, Canada April 23-28
- Grain Analyzer - Kansas City, MO August 18-20
- Weighing Sector - Ottawa, Canada August 29-31
- Measuring Sector - Gulfport, MS October 22-23

NTEP Adoption by States

- Report of Scale Manufacturer's Association efforts

Amendment of Pre-NTEP Certificates

- Not all pre-NTEP Certificates are equal
  - Most had little or no test data
  - Some had virtually complete data
- Blanket restriction on update of pre-NTEP certificate may be too restrictive

NTEP 2 - Test Data Exchanges

- US/Canada Mutual Recognition
- Bilateral Arrangements with other countries and Impact of MAA
- Can and will NCWM Issue R76 and R60 Certificates under the MAA?

Participation in International Standards

- Report on US participation in OIML Technical Committee work
- Report on 2004 Canadian Forum on Trade Measurement
- Report on 2004 APLMF and CIML Meetings
- Report on US National Working Group R76/R60

What is Harmonization?

- What are our obligations?
- Removal of technical trade barriers
- Harmonization does not require that standards be identical, but it helps

What makes harmonization difficult?

- Regulatory Documents not aligned
  - US standards directed toward the field
  - OIML directed toward type approval
- Unique US standards set us apart from the rest of the world, examples
  - Customary units
  - Class III and IIIL scales and LMD's
  - Mix and Match

Making it Happen

- Identify technical barriers to trade
- Decide what to change, OIML, NCWM, or NTEP
- Set priorities for change
- Educate on needs and benefits
- Promote action at appropriate level with assurance of due process

Three-Pronged Approach

- NIST ILG to take US proposals to OIML technical work
- NCWM S&T and L&R Committees to consider changes to NCWM standards
- NTEP Sectors and Committee to consider changes to NTEP

NTEP 6 - NCWM & US NWG

- Bring together experts in the field to review OIML standards activities
- Needs a mix of industry experts, regulatory officials, NIST ILG staff
- R76/R60 meeting in August just the first of many to come
- Shouldn't this group be part of NCWM process of Harmonization?

NTEP 7 - Mix and Match

- Enforcement problem - L&R item covers changes to NTEP regulation
- Is US mix-match system outdated?
  - Can we really assess compatibility?
  - Do we consider all necessary issues?
  - Should we consider the OIML Apportionment of Errors?

What is the US going to Do?

- Can we even participate in MAA when we have so many differences?
- Are we prepared to accept test results from other labs under MAA?
- Can the NTEP labs afford to meet international scrutiny?
- Can NTEP labs compete with national labs that are subsidized?

Critical Question

- How important is it for the US to be part of the international market in trade devices?
- Is the ability to issue OIML Certificates under the MAA a CORE VALUE to the US?

Appendix F

NTEP Status by State